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PHYSICS ABSTRACTS

BEING

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ABSTRACTS 319-513
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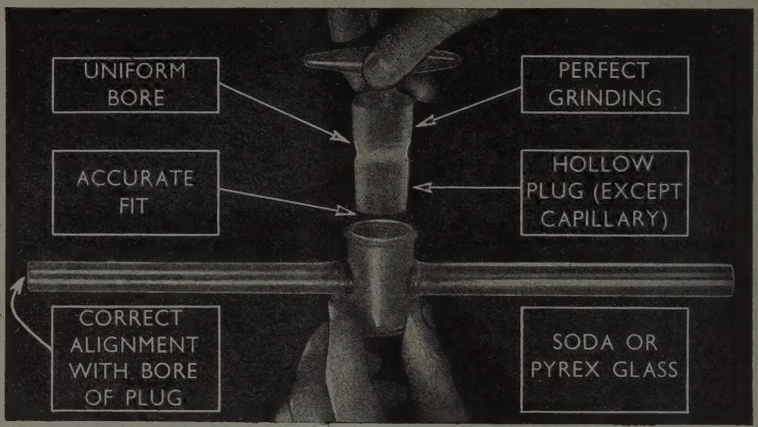
HIGH VACUUM GLASS STOPCOCKS

Bores from 1—15mm

Single and two-way patterns



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159.1 : 530.1 319

Chance, freewill and necessity in the scientific conception of the universe. WHITTAKER, E. T. *Proc. Phys. Soc., Lond.*, 55, *pp.* 459–471, *Nov.*, 1943.—After a brief discussion of the philosophical and physical conceptions of freewill and determinism, the importance of hidden parameters on certain chance phenomena (crypto-determinism) is outlined. From an investigation of four probability problems of quantum mechanics it is concluded that, for certain classes of phenomena, crypto-determinism is definitely disproved and a genuine indeterminism exists. A further enquiry into the association of determinism with the postulate of causality leads to a physical concept of causality, based on the principle of induction rather than on Kant's postulate. In extending the discussion to the human problem it is shown that the interior life, too, is not crypto-deterministic but that both in the physical and in the psychical domain there exists a continual succession of intrusions or new creations. R. H. G.

511.15 320

Natural logarithms of small prime numbers. UHLER, H. S. *Proc. Nat. Acad. Sci., Wash.*, 29, *pp.* 319–325, *Oct.–Nov.*, 1943.

511.83 : 517.522 321

The three infinite harmonic series and their sums (with topical reference to the Newton and Leibniz series for π). SODDY, F. *Proc. Roy. Soc. A*, 182, *pp.* 113–129, *Dec.* 16, 1943.—[See Abstr. 1186 (1942)]. General expressions are given for the sums of the two doubly-infinite series, symbolized as ${}^{A}S_{D}$ and ${}^{C}S_{D}$ for the series of alternating and of continuous sign, respectively, and the singly-infinite series of alternating sign, ${}^{A}S_{S}$, or, since this alone has a finite sum, simply S_S. The harmonic series is defined as a series of any number of terms which are the reciprocals of numbers in arithmetic progression, whether continuous or alternating in sign. In this symbolism, the "first term" a and the "common difference" d of the cognate arithmetical progression are denoted, ${}^{A}_{d}S^{a}_{D}$, ${}^{C}_{d}S^{a}_{D}$ and ${}_{d}S^{a}_{S}$. The successive terms both of the Leibniz series for $\pi/4$, and that of Newton for $\pi/(2\sqrt{2})$ to be cited—1, $\frac{1}{3}$, $\frac{1}{5}$, $\frac{1}{7}$, $\frac{1}{9}$, $\frac{1}{11}$, etc.—are numerically in the ratio of the wavelengths of the fundamental tone and the successive harmonics of the closed or "stopped" organ pipe.

513.83 322

On convex topological linear spaces. MACKEY, G. W. *Proc. Nat. Acad. Sci., Wash.*, 29, *pp.* 315–319, *Oct.–Nov.*, 1943.—[See Abstr. 2467 (1943)].

517.512.2 : 518.3 : 548.73 *see Abstr.* 465, 466

517.522 : 511.83 *see Abstr.* 321

517.947.42 323

Relaxation methods applied to engineering problems. VIII. Plane-potential problems involving specified normal gradients. SOUTHWELL, R. V., AND VAISEY, G. *Proc. Roy. Soc. A*, 182, *pp.* 129–151, *Dec.* 16, 1943.—Since every plane-harmonic function is associated with a conjugate, problems in which normal gradients are specified on the boundary can be transformed into problems in which boundary values are specified. There remains the problem of deducing a function ψ from its conjugate ϕ, and this, when the conjugate has been determined only approximately, entails uncertainties [Abstr. 1996 (1940)]. To minimize the errors of approximate computation, ψ and ϕ should be determined severally and independently, consequently a method of direct attack is still needed on problems in which normal gradients are specified. Two methods are propounded for the satisfaction of mixed boundary conditions, the first applicable also to cases in which normal gradients alone are specified. Test examples indicate that the wanted extension of method is now available.

518.3 : 517.512.2 : 548.73 *see Abstr.* 465, 466

518.3 : 551.547.1 *see Abstr.* 492

519.24 : 62 324

The combination of probability curves in engineering. WILKINSON, R. I. *Trans. Amer. Inst. Elect. Engrs*, 61, *pp.* 953–963, *Dec.*, 1942. *Suppl.*—Deals with the moments and characteristics of the commoner frequency distributions, and with the practical and analytical derivation of the distributions representing the sum, difference, product and quotient of quantities which are themselves distributed according to these commoner laws, e.g. rectangular, normal, Poisson and Pearson's Type III. In some cases the mean and std. deviation of the derived distribution can be expressed in terms of the like parameters of the original distributions.

519.41 : 541.62 325

Application of Polya's theorem to optical, geometrical, and structural isomerism. TAYLOR, W. J. *J. Chem. Phys.*, 11, *p.* 532, *Nov.*, 1943.—[See Abstr. 2291 (1943)].

519.444 326

Subgroups transformed according to a group of prime order. MILLER, G. A. *Proc. Nat. Acad. Sci., Wash.*, 29, *pp.* 311–314, *Oct.–Nov.*, 1943.

521.032 : 523.852.3 327

On the lifetime of clusters of extragalactic nebulae. TUBERG, M. *Astrophys. J.*, 98, *pp.* 501–503, *Nov.*, 1943.—Chandrasekhar's dynamical-friction theory [Abstr. 2478 (1943)] is extended to clusters of nebulae. Relaxation times of the order of 10^9 to 10^{10} years are found, implying an upper limit of 10^{10} to 10^{11} years to the age of the universe. A. HU.

521.041 328

Contractive evolution of massive stars. GAMOW, G. *Astrophys. J.*, 98, *pp.* 498–500, *Nov.*, 1943.—The author calculates the evolutionary track of a star of 10 times the Sun's mass, which has already used up its H in the C–N reaction and is contracting gravitationally. The calculations fit the Wolf–Rayet stars, and it is suggested that matter ejected from such stars is slowed down by gravitational forces so that in 10^3 to 10^4 years they become planetary nebulae with nuclei several magnitudes fainter than the original stars and of central temperatures about 10^9 deg. In this state the escape of high-energy neutrinos will then produce a sudden collapse observed as a supernova explosion. A. HU.

521.041 : 523.877 329

On WC and WN stars. GAMOW, G. *Astrophys. J.*, 98, *pp.* 500–501, *Nov.*, 1943.—It is estimated that if the central temperature of a star undergoing the C–N nuclear reaction increases from 2×10^7 to 5×10^7 deg., the abundance ratio N/C must drop by a factor of 10. Thus more massive (brighter) stars should show a preponderance of C as compared with N. The 2 groups of Wolf–Rayet stars are in accord with this, WC stars being, on the average, brighter than WN stars. It is suggested that the energy transport through the outer envelope is accomplished by convection currents which produce this effect by bringing material from the energy-producing regions to the observable surface. A. HU.

521.312 : 523.842.3 *see Abstr.* 342

522.21 : 535.313.2 : 681.4 330

Parabolizing mirrors without a flat. ROSS, F. E. *Astrophys. J.*, 98, *pp.* 341–346, *Nov.*, 1943.—A parabolic mirror can be tested at its centre of curvature by making use of the spherical aberration of a suitably designed simple convex lens or spherical concave mirror just inside or outside the centre respectively. In most cases sufficiently perfect parabolization results. In the exceptional case of the 200 in. mirror for Mt. Palomar, the auxiliary lens designed cannot make a full correction, and a further correcting plate is necessary. A. HU.

522.23 : 523.45 *see Abstr.* 336

522.25 331

Air currents within the reflector tube. WHITE, E. K. *J. Roy. Astr. Soc. Can.*, 37, *pp.* 377–378, *Nov.*, 1943.—Experiments are described showing the effect of forced ventilation in the closed tube of a reflecting telescope. The definition of the extra-focal rings of a bright star and of planetary and lunar detail is unaffected in poor seeing (0–4) but is slightly improved in better conditions (5–7). Other disadvantages in using a fan are considered to outweigh this slight improvement. A. HU.

523.13 332

Non-solar planetary systems. JEANS, J. H. *Nature, Lond.*, 152, *p.* 721, *Dec.* 18, 1943.—[See Abstr. 30 (1944)].

523.13 333

Non-solar planets and the origin of the solar system. ALFVÉN, H. *Nature, Lond.*, 152, *p.* 721, *Dec.* 18, 1943.

523.162.2 : 523.872 *see Abstr.* 344

523.42 334

Observations of Venus in 1943. MORGAN, F. P. *J. Roy. Astr. Soc. Can.*, 37, *pp.* 353–354, *Nov.*, 1943.—Observations and drawings made on a 6 in. refractor are given for the period May–Aug., 1943. A. HU.

523.45 335

The 1940–41 apparition of Jupiter. HAAS, W. H., AND JOHNSON, H. M. *J, Roy. Astr. Soc. Can.*, 37, *pp.* 357–373, *Nov.*, 1943.—The authors continue a previous summary of visual observations [Abstr. 742 (1941)]. The relative conspicuousness and colours of the belts are discussed. The probable error of a Jovian transit is put at about 1·2° from observations of the centre of the Red Spot. A table of rotation periods of various currents is given. A. HU.

523.45 : 522.23 336

The Jovian transit observation problem and an instrumental solution. JOHNSON, H. M. *J. Roy. Astr. Soc. Can.*, 37, *pp.* 374–376, *Nov.*, 1943.—A method is suggested for avoiding the necessity of estimating by eye the central meridian of the telescopic image of Jupiter in transit work. Annular cylindrical lenses in the optical train are arranged to form luminous reference lines whose coincidence determines the artificial central meridian. The optical problems involved are briefly discussed. A. HU.

523.5 337

The velocities of meteors. MCINTOSH, R. A. *J. Roy. Astr. Soc. Can.*, 37, *pp.* 305–315, *Oct.*, 1943.—The mean velocities observed by Denning for shower meteors are shown to agree closely with the theoretical values, showing that the observed velocities are more accurate than has been believed. The velocity/height relation shows that increased velocity is associated with increased height, that fireballs begin higher and end lower than meteors, and that shower objects of both types begin and end higher than sporadic ones. A comparison of real heights determined by independent computers shows a small mean divergence and suggests that a mean height derived from 50 meteors may be in error by a mile. A. HU.

523.746 : 550.384 *see Abstr.* 472

523.841.3 338

The spectrum-variable 73 Draconis. DURHAM, G. E. *Astrophys. J.*, 98, *pp.* 504–506, *Nov.*, 1943.—A series of spectrograms taken during 1941–43 confirms the variation of intensity of the Eu II line at 4 205 Å and some others in a period of 20·27 days. Other elements show no intensity variation, and no variation in radial velocity can be detected. A. HU.

523.841.3 : 523.872 339

The spectrum of BF Cygni. MERRILL, P. W. *Astrophys. J.*, 98, *pp.* 334–340, *Nov.*, 1943.—A detailed study of line intensities and displacements in this spectrum is made from spectrograms taken during the period 1940–43. The forbidden lines of Fe III are stronger than in any other stellar spectrum. Comparisons are made with other "combination" spectra, and a comparative study is suggested for explaining the obscure problems involved in the production of such spectra. A. HU.

523.841.3 : 523.872 *see Abstr.* 345

523.841.35 : 523.872 340

Spectroscopic observations of T Arietis. JOY, A. H., AND MERRILL, P. W. *Astrophys. J.*, 98, *pp.* 331–333, *Nov.*, 1943.—Spectrograms of this long-period variable star show that its spectral type varies from M6*e* to M8, emission lines being present except near min. Radial velocities of the absorption lines have a range of 8·6 km./sec., but are not certainly correlated with phase. The emission lines are displaced with resp. to the absorption lines by ½ the amount shown by a typical Mira variable of the same period. A. HU.

523.842.2 341

A spectrographic study of the triple system in 59*d* Serpentis. TILLEY, E. C. *Astrophys. J.*, 98, *pp.* 347–

360, *Nov.*, 1943.—Spectrograms of the primary component of this visual binary, itself a triple system giving a composite G0–A2 spectrum, are used to derive the orbital elements. The G star has a period of 386 days, the A-type binary one of 1·85 days. Approx. values are derived for the masses, inclinations and radii of the components. No eclipses can take place. A. HU.

523.842.3 : 521.312 342

The orbits of the spectroscopic binary HD 93075. NORTHCOTT, R. J. *J. Roy. Astr. Soc. Can.*, 37, *pp.* 339–342, *Oct.*, 1943.—Scatter about the mean velocity curve of this star is shown by more powerful spectrographic equipment to be due to the spectrum of a second component. Orbital elements are derived from 7 plates, assuming zero eccentricity. A. HU.

523.852.3 : 521.032 *see Abstr.* 327

523.872 343

Effective wavelengths of standard magnitudes: colour temperature and spectral type. SEARES, F. H., AND JOYNER, M. C. *Astrophys. J.*, 98, *pp.* 302–330, *Nov.*, 1943.—Effective wavelengths are derived for the international system of photographic and photovisual magnitudes. Black-body colour indices corresponding to these wavelengths are calculated for a series of temperatures. Colour temperatures corresponding to observed colour indices for the std. spectral types are also derived, assuming 11 000°K. for A5 stars. Similar calculations made for the photo-electric colour indices of Stebbins result in colour temperatures which are systematically lower, and several sources of error are examined to account for the discrepancy. A. HU.

523.872 : 523.162.2 344

Discussions of colour index and spectral type. SEARES, F. H., AND JOYNER, M. C. *Astrophys. J.*, 98, *pp.* 261–301, *Nov.*, 1943.—The colour indices of the Mt. Wilson Polar Catalogue, corrected for a magnitude error, are used in conjunction with spectral types for the same stars to derive the spectrum/colour relation and thence to investigate colour excess as a function of distance. Up to 450 parsec the colour excess increases by 0·06 mag. per 100 pc.; from 450 to 700 pc. it is const. at 0·27 mag. The residuals from a linear relation are composed of deviations from the mean absorption, of dispersion in colour for stars of the same spectral type, and of observational errors. A partial separation of these is attempted and numerical estimates made of the various influences. A. HU.

523.872 : 523.841.3 345

The spectrum of α^2 Canum Venaticorum. STRUVE, O., AND SWINGS, P. *Astrophys. J.*, 98, *pp.* 361–497, *Nov.*, 1943.—A comprehensive list of wavelengths and identifications is given for 3 107 absorption lines betw. 3 088 Å and 4 741 Å. All known singly-ionized rare earths are represented, and Ce III is almost certainly present. The lines are grouped into 3 classes by intensity and radial velocity: one contains the rare-earth lines varying in intensity in a period of 5·5 days and showing a shallow velocity min. and sharp max.; another contains lines of Cr II and other elements which vary in intensity in the opposite sense and show a velocity curve with a double wave; the third consists of Si II, Mg II and other lines which are const. in intensity and in velocity. A. HU.

523.872 : 523.841.3 *see Abstr.* 339

523.872 : 523.841.35 *see Abstr.* 340

523.873 346

Some comparisons of spectral classifications. SEARES, F. H., AND JOYNER, M. C. *Astrophys. J.*, 98, *pp.* 244–260, *Nov.*, 1943.—The stellar spectral classification systems used at Harvard, Mt. Wilson, Upsala, Bergedorf and Yerkes are compared, and regression-difference curves and average accidental errors in the spectral differences are derived. Small differences depending on magnitude are noted. Accidental errors vary considerably with type, partly owing to unequal intervals betw. the subtypes. Systematic differences betw. the various series are of the order of 0·1 class. A. HU.

523.877 : 521.041 *see Abstr.* 329

526.7 347

Use of the gravity meter in establishment of gravity bench marks. MCCOLLUM, E. V., AND BROWN, A. *Geophysics*, 8, *pp.* 379–403, *Oct.*, 1943.—Data are presented showing comparisons between gravity meters and networks of gravity-meter bench marks. Methods of adjustment of networks for closure are suggested. Ties to pendulum stations of the U.S. Coast and Geodetic Survey and the Dominion Observatory of Canada afford a basis for the calibration of the gravity meters used and the evaluation of the gravity-meter bench marks in terms of the world gravity network. Probable errors and accuracies are discussed.

526.72 = 3 348

Increased-sensitivity astatic pendulum gravimeter for observing variations of gravity with time. LAGERQVIST, P. A. *Ark. Mat. Astr. Fys.*, 28*A*, 1, *No.* 7, [20 *pp.*], 1942.—An Ising astatic pendulum gravimeter is modified for laboratory use with the view to observing the diurnal variations of gravity. The ordinary difference method with visual observations gives results with a mean error of $2 \cdot 5 \times 10^{-2}$ mgal. A difference method using an unstable pendulum with specially designed automatic registration apparatus gives a mean error of 1×10^{-2} mgal. The gravimeters show variations of the expected order over a period of a few days. Further progress in increasing the sensitivity will come by better temperature control and stricter selection of site, and by using pendulum fibres of small secular creep. A. HU.

526.77 : 551.243.1 349

Faulting in the Billings Oilfield, Oklahoma, as interpreted from torsion-balance data, and from subsequent drilling. KLAUS, H. *Geophysics*, 8, *pp.* 362–378, *Oct.*, 1943.—The results of an experimental torsion-balance survey are shown by conventional maps and second-derivative contour maps. The latter show anomalies, which are interpreted as faulting. One of the faults limiting the field has been defined in detail by drilling, and the present subsurface interpretation is compared with the original torsion-balance predictions. It is concluded that the torsion balance can still be used effectively for specialized purposes, particularly the investigation of faulting.

53.081.5 350

Units and dimensions. JEFFREYS, H. *Phil. Mag.*, 34, *pp.* 837–842, *Dec.*, 1943.—To avoid the difficulty involved in the statement that the ratio of the e.s. and e.m. units of charge is the velocity of light, it is suggested that the coulomb should alone be used, the fundamental law of electricity and magnetism being taken to be that of the force between two electric currents *in vacuo*. Magnetic moment then has the dimensions [QL²/T], which differs from Duncanson's result by a factor μ, the permeability of a vacuum. [See Abstr. 43 (1943)]. A. W.

530.1 : 159.1 *see Abstr.* 319

530.12 : 530.145 *see Abstr.* 352

530.145 351

On Dirac's new method of field quantization. PAULI, W. *Rev. Mod. Phys.*, 15, *pp.* 175–207, *July*, 1943.—The paper discusses the theory based on the use of an indefinite metric in the space of quantum states combined with the λ-limiting process. Convergence difficulties can be overcome in this way but it is necessary to suppose that operators with only pos. eigenvalues can have neg. expectation values. The difficulties of interpreting the theory physically are discussed. The subjects treated in detail are: the harmonic oscillator, a system of 2 oscillators with pos. and neg. energy, unchanged particles with spin 0 and 1 and Bose statistics, charged particles, the λ-limiting process and electrostatic self-energy, neg.-energy protons and the electrodynamic part of the self-energy in the e^2 approximation.

G. C. McV.

530.145 : 530.12 352

Combination of relativity theory and quantum theory. EDDINGTON, A. S. *Commun. Dublin Inst. Advanced Stud. A, No.* 2, [69 *pp.*], 1943.—Deals with the uncertainty of location of a physical frame of reference rel. to a geometrical frame. The origin of the former has a Gaussian probability distribution rel. to the latter, and spherical space is a device for taking into account the uncertainties in the locations of the particles in a large aggregate. The relation betw. the range of nuclear forces and the recession of the nebulae is discussed. The energy tensor and its expression in a form which exhibits the number of components is discussed. The mass-ratio 1 847·6 for the proton and electron is obtained and a set of "rigid" co-ordinates is defined, in terms of which the characteristics of the field are stationary. Electrical theory on the basis of the "unobservable interchangeability" of particles is discussed. A new formula is obtained for the electronic mass as a function of the quantum const., the number of particles in an Einstein universe and the radius of the latter. G. C. McV.

530.145 : 538.3 353

Quantum electrodynamics. DIRAC, P. A. M. *Commun. Dublin Inst. Advanced Stud. A, No.* 1, [36 *pp.*], 1943.—Special relativity only is envisaged, as invariance under Lorentz transformations alone is considered. The author's bracket notation is defined and used in Fock's treatment of the harmonic oscillator. Fock is again followed in the general theory of particles obeying Bose statistics (bosons), and it is shown that an assembly of bosons is mathematically equivalent to a set of harmonic oscillators. The modifications necessary to secure invariance under Lorentz transformations are worked out for particles of zero rest mass, and this leads to the theory of photons. The equations of motion of a set of interacting electrons in a given electromagnetic field are worked out on classical electrodynamics. The elimination of the longitudinal waves of the field is achieved. This classical theory is taken over into quantum theory by making all dynamical variables into operators satisfying commutation relations.

G. C. McV.

530.145.5 : 537.12 : 535.336 : 537.533 : 538.083.9 = 3 *see Abstr.* 403

531.225 354

The approximate mathematical methods of applied physics as exemplified by application to Saint-Venant's torsion problem. HIGGINS, T. J. *J. Appl. Phys.*, 14, *pp.* 469–480, *Sept.*, 1943.—The paper [see Abstr. 804 (1943)] is devoted to an exposition of the known solutions of the problem for a prism of uniform cross-section. It discusses those solutions according as they stem from the calculus of variations, from the theory of linear difference equations, and from the use of graphic analysis. G. E. A.

531.252 355

A lattice analogy for the solution of stress problems. MCHENRY, D. *J. Instn Civ. Engrs*, 21, *pp.* 59–82, *Dec.*, 1943.—Describes a computation method for numerical solution of almost any type of 2-dimensional stress problem involving elastic materials; it is one of successive approximation. The method is derived in 2 ways, one employing Taylor's theorem, and the other by the lattice analogy in which each small element of the section is replaced by a braced square frame composed of 6 elastic members which have certain defined properties. The solution of the lattice is exemplified by the case of a plate stressed by forces acting in its plane; determination of the stresses follows. Hints are given on the successful application of the method. G. E. A.

531.724 : 662.66 : 539.217.1 : 536.658.2 *see Abstr.* 396

532.133 : 532.14 : 541.66 356

Viscosities and rheochors of nitric acid, nitroparaffins, and their isomeric nitrites. FRIEND, J. N., AND HARGREAVES, W. D. *Phil. Mag.*, 34, *pp.* 810–816, *Dec.*, 1943.—Compounds containing a co-ordinate bond have a higher b.p. than their isomers containing only covalent links. Measurements tabulated and plotted for 12 substances show that the densities, viscosities and latent heats at comparable temperatures are greater for the nitroparaffins than for the corresponding nitrites. Calc. mean vals. for the rheochors [see Abstr. 2708 (1943)] are: NO_2 = 38·9, ONO = 39·3. The val. for HNO_3 at the b.p. is 53·7. N. M. B.

532.14 : 541.66 : 532.133 *see Abstr.* 356

532.61.08 : 541.265 357

Surface tension of *n*-heptane and *n*-butane containing dissolved nitrogen. RENO, G. J., AND KATZ, D. L. *Industr. Engng Chem.*, 35, *pp.* 1091–1093, *Oct.*, 1943.—Surface tensions were measured [see Abstr. 1362 (1943)] of *n*-heptane containing dissolved N_2 at 200, 500 and 1 000 lb./in.² at 77°, 131°, and

185°F., and of *n*-butane containing N_2 at these pressures at 77°F. The data were used to compute a parachor for N_2 dissolved in *n*-heptane of 41. When dissolved in *n*-butane, the parachor for N is 60 which is in agreement with the value obtained for pure N_2.

532.612.4 : 541.182.4 358

Surface tension of sodium soap dispersions in mineral oils. GALLAY, W., AND PUDDINGTON, I. E. *Canad. J. Res. B*, 21, *pp.* 225–229, *Nov.*, 1943.—The surface tension of sodium stearate and sodium oleate dispersions in mineral oils of high and low viscosity index was measured over a wide range of temperature. In dispersions in the non-polar oil, no surface activity is shown by the soap until the full m.p. is reached. In dispersions in an oil of relatively high polarity, surface activity is shown at much lower temperatures corresponding to partial m.p. of the soaps. The ability of the soap to lower the surface tension is dependent on the deg. of dispersion of the soap, and the relation of surface activity to physical states and phase transition [Abstr. 313, 314 (1944)] is discussed. The addition of glycerol increases the surface activity at a given conc., but the temperature at which surface activity is attained remains unaffected. Excess fatty acid acts similarly to glycerol; excess alkali decreases surface activity. The oils had a viscosity of 900 S.U.S. at 100°F. A capillary-rise method was used.

532.612.4 = 3 359

Surface tension, co-ordination number and Eötvös rule. WOLF, K. L., AND GRAFE, R. *Kolloid Z.*, 98, *pp.* 257–262, *March*, 1942.—[See Abstr. 390 (1942)]. A new determination based on measurements of molar surface energy and its temperature coeff. or Eötvös const., respectively, is made of Stephan's number (ϕ) for some pure substances, and its relation to the co-ordination number 12, valid for these substances, is stated. The influence of the packing of the molecules on ϕ with regard to size and dependence on conc. are discussed. Regarding the packing of spheres of different diameters, special investigations based on group theory are still to be made. Therefore, for liquid mixtures only the max. deviation of ϕ from the ordinary mixture rule can at present be given. R. N.

532.64 : 541.182.4 360

Wetting power in sodium-soap–mineral-oil systems. GALLAY, W., PUDDINGTON, I. E., AND TAPP, J. S. *Canad. J. Res. B*, 21, *pp.* 230–235, *Nov.*, 1943.—Measurement of the contact angle, by the plate method, of mineral oils on surfaces of sodium soaps showed no appreciable variation with oils of varying polarity. Low-viscosity oils show a low interfacial tension against water, and greater emulsion stability. Mineral oils possess high spreading power on soap surfaces previously wet with glycerol. As a result, mineral oils are rapidly absorbed by a soap-glycerol gel, and the glycerol is displaced and forced out of the gel. Data are shown for some quantitative measurements of this preferential wetting action, various oils and elevated temperatures being used. These experiments are extended to sodium-soap-base lubricating greases, and the presence of free glycerol is demonstrated in such systems where fats were used in the manufacture of the grease.

532.71 : 532.77 : 541.18 361

The osmotic activity of colloidal electrolytes. MCBAIN, J. W., AND BRADY, A. P. *J. Amer. Chem. Soc.*, 65, *pp.* 2072–2077, *Nov.*, 1943.—All data for osmotic coeffs. of colloidal electrolytes are brought into coincidence on 1 of 3 curves, by changing the scale of conc. There is one curve for straight-chain compounds, one for branched and one for polycyclic colloidal electrolytes. The osmotic and conductivity data indicate the presence of a small proportion of highly conducting micelles in very dilute solutions. The addition of KCl or of K_2SO_4 to very dilute solutions of K laurate promotes the formation of colloid, so that the result is distinctly less than additive; in higher conc., where the colloid is already fully formed, the effect on f.p. lowering is more than additive. There is no marked indication of high ionic strength.

532.77 : 541.18 : 532.71 *see Abstr.* 361

533.17 : 536.46 *see Abstr.* 391

533.17 : 539.16 *see Abstr.* 408

533.275 : 551.508.71 *see Abstr.* 478

533.6.013.22 : 551.576.1 *see Abstr.* 495

534.1 362

The transient state and the analysis of shock-excitation. MANLEY, R. G. *Engineering*, 156, *pp.* 321–322, *Oct.* 22, *and pp.* 361–362, *Nov.* 5, 1943.—Analysis suggests 2 methods of computing the response to a periodic load-variation of the shock-excitation type. One method results in the introduction of numerous transient terms, the steady state being reached as the limit sum of a convergent series superimposed on the forced motion. The second method, using Fourier series, gives the steady-state motion at once, the single (starting) transient term being obtained from initial conditions of the motion. G. E. A.

534.15 : 534.647 363

The design of vibration pick-up units. POSTLETHWAITE, F. *Engineering*, 156, *pp.* 362–364, *Nov.* 5, 1943.—The seismic type of vibrograph is one in which a spring-controlled mass remains materially stationary for high-frequency vibrations, and the movement of the mass relative to the case is recorded on a moving film by an optical magnifying system. The theoretical performance of seismic vibrographs in general is discussed, and families of curves are drawn to show the variation of R and θ with N, where R is the ratio recorded/applied amplitude, θ is angle of lag, and N is the ratio applied/natural frequency. Discussion of the curves brings out what is regarded as the ideal performance in frequency and amplitude for a pick-up unit. G. E. A.

534.372 364

Vibration absorption with structural rubber. DEVORSS, J. W. *Engng J. Can.*, 26, *pp.* 509–512, *Sept.*, 1943.—If a mechanism is supported on resilient mountings so that its natural frequency is $\ll$ the forced frequency, a large part of the vibration of the mechanism will be isolated, the effectiveness of the mounting being given by the insulation ratio: (forced frequency)/(natural frequency). This ratio should be 2·5 or more. The vibrations dealt with are seldom of a linear type. The rubber is used primarily in

compression and shear; its technical applications are described and a nomograph is added for determining deflections of rubber in compression when adhering between parallel metal plates. The physical properties of 6 std. rubbers are tabulated. G. E. A.

534.647 : 534.15 *see Abstr.* 363

534.647 : 550.342 365

Recent developments in rockburst research at Lake Shore Mines. HODGSON, E. A. *Trans. Dom. Obs., Ottawa*, 46, *pp.* 313–324, 1943.—The development of high pressures in mine rocks is indicated by means of geophones which detect piezo-electrically the "sub-audible snaps" which accompany slight yielding. The currents produced in the geophones are amplified to operate pen recorders. Suitably situated geophones can indicate h.p. zones, and detect their shift from one point to another, and their development to danger point. A. HU.

535.241.34 366

A yellow glass filter for colour-temperature measurements. HARDING, H. G. W. *Proc. Phys. Soc., Lond.*, 56, *pp.* 21–30, *Jan.*, 1944.—A glass filter is described which enables the colour temperature of lamps to be measured, using std. lamps which operate at lower colour-temperatures. The filter is yellow in colour and made from Corning 346 and 507 glasses. The method of construction is described. Colour-temperature measurements made with the glass filter agree to 4°K. with those using the blue liquid filter. The yellow filter is more stable, the colour-matching properties are better, the energy match is better for a colour match, the temp. coeff. is 1/5 that of the blue filter, and the yellow filter is placed in front of the brighter lamp, so that the lamps are nearly equidistant from the photometer.

535.243 : 535.81 367

Some spectrophotometric investigations on iron-oxide-containing soda-lime-silica glasses. I. The influence of concentration and ferric-ferrous dissociation. WANG, T. H., AND TURNER, W. E. S. *Phil. Mag.*, 34, *pp.* 744–766, *Nov.*, 1943.—[Abstr. 1921 (1943)].

535.247.4 : 545.726 : 614.72 368

Photo-electric photometer for determining carbon disulphide in the atmosphere. SILVERMAN, S. *Industr. Engng Chem. (Analyt. Edit.)*, 15, *pp.* 592–595, *Sept.* 15, 1943.—Describes a quick (and, if desired, continuous recording) method of determining CS_2 conc. between 2 and 200 p.p.m. by vol. The method depends on the use of a photocell set-up to measure the light-absorption of the air around wavelength 310 mμ. None of the other contaminating vapours from the viscose process absorbs in this region. J. W. T. W.

535.31 369

Mathematical proof of Stokes's reversibility principle. MAHAN, A. I. *J. Opt. Soc. Amer.*, 33, *pp.* 621–626, *Nov.*, 1943.—A mathematical demonstration of Stokes's principle of reversibility and, in particular, Arago's law which states that light is reflected in the same proportions at the two surfaces of a plane-parallel plate. It is shown that the principle, as originally stated, cannot be established by experiment. J. W. T. W.

535.313.2 : 681.4 : 522.21 *see Abstr.* 330

535.317 : 535.51 370

A note on the polarization of a plane polarized wave after transmission through a system of centred refracting surfaces, and some effects at the focus. HOPKINS, H. H. *Proc. Phys. Soc., Lond.*, 56, *pp.* 48–51, *Jan.*, 1944.—Three special cases can be distinguished: the one in which θ, the semi-angular aperture of the system, is small, whereas the angles of incidence within the system are large; the second, in which θ is comparatively large, whereas the transmission of energy along marginal ray-paths can be regarded as complete; the third, in which both θ and the angles of incidence are small. The assumption concerning the planes containing the light vectors [Abstr. 1049 (1943)] is not strictly valid. The approximation, however, is close.

535.325 : 535.417 371

The refraction and dispersion of sulphuretted hydrogen, sulphur dioxide and carbon oxysulphide. HUXLEY, H., AND LOWERY, H. *Proc. Roy. Soc. A*, 182, *pp.* 207–216, *Dec.* 16, 1943.—An advance in the technique of using the Jamin interferometer for the determination of the dispersion of gases has been effected by making a systematic allowance for fringe-drift by means of photographic measurements. New values of the refraction and dispersion of SO_2 and H_2S have been determined, reduced to infinite dilution by means of newly measured pressure coefficients, in order to allow for departure from the gas laws. The refraction and dispersion of COS have been measured for the first time.

535.327 : 537.228 372

The refractive index of an ionized medium. II. DARWIN, C. *Proc. Roy. Soc. A*, 182, *pp.* 152–166, *Dec.* 16, 1943.—The paper clarifies an earlier result [Abstr. 3712 (1934)] which showed that the refr. index of an ionized medium is $\mu^2 - 1 = -4\pi Ne^2/mv^2$ by a direct analysis of the effects of collisions betw. free electrons and positive ions. The perturbation of the electron's path by the light has a secondary effect during a collision, so that, if before entry into collision its position was displaced sideways, it will emerge from the collision with a changed velocity. The average effect is equiv. to an acceleration, which reduces the effective force on the electron from $E + 4\pi P/3$ to E. This is proved for a positive ion composed of a uniform spherical charge, for a proton, and for any centrally symmetrical distribution of charge.

535.332.03-31 : 546.28 = 3 373

Vacuum spark spectrum of silicon in the extreme ultra-violet. FERNER, E. *Ark. Mat. Astr. Fys.*, 28*A*, 1, *No.* 4, [21 *pp*], 1942.—A grazing-incidence vacuum spectrograph is used to investigate the spectrum of a 65 kV spark betw. Si electrodes. Wavelengths, intensities and identifications are given for 301 Si lines betw. 43 and 236 Å, and term schemes are derived for the spectra Si V to Si XII. A. HU.

535.336 : 537.12 : 530.145.5 : 537.533 : 538.083.9 = 3 *see Abstr.* 403

535.338 374

On the continuous spectrum of hydrogen-like atoms (parabolical co-ordinates). MORGANS, W. R. *Phil. Mag.*, 34, *pp.* 842–850, *Dec.*, 1943.—Expressions for

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the intensities for transitions between the continuous and the discrete states when the co-ordinates are parabolical co-ordinates are calculated for the Lyman and the Balmer states.

535.338.334 = 3 375

Theory of broadening of spectral lines. LINDHOLM, E. *Ark. Mat. Astr. Fys.*, 28*B*, 1, *No.* 3, [11 *pp.*], 1942.—A quantum-mechanical theory of pressure broadening and displacement of spectral lines is developed. Numerical calculations are carried out for the case of Na atoms in an atmosphere of A. The half-widths and displacements found agree with the experimental values. A. HU.

535.338.4 : 536.46 : 546.262.3 376

The flame spectrum of carbon monoxide. III. The cool flame. GAYDON, A. G. *Proc. Roy. Soc. A*, 182, *pp.* 199–206, *Dec.* 16, 1943.—[See Abstr. 1280 (1941)]. The spectra of the cool flames, or pre-ignition glows, of CO with O_2 and with N_2O have been photographed. The cool flame shows the same faintly banded spectrum as the normal flame, but this band structure is more clearly developed. The OH bands are absent from the cool flame, which, however, shows strong Na emission. CuCl appears readily as an impurity and the band systems of CuCl show a markedly different intensity distribution in the cool flames with O_2 and with N_2O. The application of the results to the theory of the combustion mechanism is discussed.

535.343 377

The *y* bands in absorption spectra. LEWIS, G. N., AND BIGELEISEN, J. *J. Amer. Chem. Soc.*, 65, *pp.* 2102–2106, *Nov.*, 1943.—When 1 of the 3 equivalent groups of crystal violet is replaced by a different group, the single absorption band is resolved into 2 (*x* and *y*) bands. The separation is greater the more the new group differs, as an auxochrome, from the old. The electronic oscillations of the two excited states are ⊥ each other. The neg. fluorescent polarizations in fluorescein and rhodamine-B are in accord with Lewis and Calvin's theory. The second band of malachite green is proved to be the *y* band by 2 methods, (1) depends on the production of oriented molecules in a rigid solvent, (2) is the method of polarized fluorescence. A new method of measuring small deg. of polarization is described. [See Abstr. 2182 (1942), 112 (1943)].

535.343 378

The second-order *x* bands in absorption spectra. LEWIS, G. N., AND BIGELEISEN, J. *J. Amer. Chem. Soc.*, 65, *p.* 2107, *Nov.*, 1943.

535.347 : 667 = 4 379

Molecular dichroism. NIKITINE, S. *Schweiz. Arch. angew. Wiss. Techn.*, 9, *pp.* 176–184, *June*, 1943.—Gives an account of previous work on the photodichroism of dyes which bleach on being illuminated. The proposed theory of this effect is compared with experimental results obtained with cyanine and other materials and good agreement is found. A second part of the paper describes a comparison between the results obtained by a study of dichroism with those found from measurements of the polarization of the fluorescent light, both of which phenomena depend on the anisotropy of the molecules of the dye. J. W. T. W.

535.417 : 535.325 *see Abstr.* 371

535.417 : 539.211 : 548 380

An interferometric procedure for the examination of crystal surfaces. TOLANSKY, S. *Nature, Lond.*, 152, *pp.* 722–723, *Dec.* 18, 1943.

535.51 : 535.317 *see Abstr.* 370

535.563 : 541.653 381

Racemization accompanying molecular rearrangements. STEVENS, P. G., AND GREENWOOD, S. H. J. *J. Amer. Chem. Soc.*, 65, *pp.* 2153–2155, *Nov.*, 1943.—Treatment of *laevo*-2,3-dimethylhexanol-2 with conc. HCl yields a mixture of 2,3-dimethyl-2-chloro- and 2,3-dimethyl-3-chlorohexane, both of which have been completely racemized. Hydrolysis yields a 1 : 1 mixture of racemic 2,3-dimethyl-hexanol-2 and 2,3-dimethylhexanol-3. Both isomeric dimethylhexanols yield the same chloride mixture with conc. HCl. The optical activity of the chloride mixture from *dextro*-2,2-dimethylhexanol-3 is due to the formation of the unrearranged secondary chloride.

535.566 : 541.653 382

An optically active selenonium salt. MANN, F. G., AND HOLLIMAN, F. G. *Nature, Lond.*, 152, *pp.* 749–750, *Dec.* 25, 1943.

535.612 : 778.6 : 535.7 *see Abstr.* 386

535.65 383

Historical background and evolution of the colorimetry report. JONES, L. A. *J. Opt. Soc. Amer.*, 33, *pp.* 534–543, *Oct.*, 1943.—Describes the course of the deliberations of the Committee on Colorimetry (Opt. Soc. Amer.) during the past decade and outlines the way by which the Committee arrived at adopting the psycho-physical concept of colour as the basis for its report [see Abstr. 387 (1944)]. J. W. T. W.

535.653.8 384

The graphical representation of small colour differences. WRIGHT, W. D. *J. Opt. Soc. Amer.*, 33, *pp.* 632–636, *Nov.*, 1943.—No linear projection of the C.I.E. chromaticity diagram can give an exactly uniform colour distribution and attempts have recently been made to find a non-linear projection that will. The personal variations in the colour discrimination function are such that, if a projection could be found to suit one observer's results, it would not suit another observer. There is therefore little justification for non-linear projections, especially as the practical applications of the chart are such that its usefulness would be little affected by minor departures from uniformity. J. W. T. W.

535.7 385

Binocular and uniocular threshold of vision. PIRENNE, M. H. *Nature, Lond.*, 152, *pp.* 698–699, *Dec.* 11, 1943.—Fluctuations at the threshold may be due to physical stimulus. The reason for the greater sensitivity of binocular vision may be that the probability of receiving a stimulus of sufficient magnitude is greater for 2 eyes than for 1. Experimental results accord with this suggestion. The binocular threshold (taken as 50% chance of detection) is about 0·1 log unit below the mean of the uniocular thresholds. J. W. T. W.

535.7 : 535.612 : 778.6 386

Visual processes and colour photography. EVANS, R. M. *J. Opt. Soc. Amer.*, 33, *pp.* 579–614, *Nov.*, 1943.—A discussion of the difficulties of producing

a coloured print which will appear to the eye to be a faithful reproduction of the original scene. The effects of colour adaptation and colour constancy are dealt with. The effect of adaptation level is considered and conclusions are drawn as regards the best viewing conditions. J. W. T. W.

535.733 387

Concept of colour. *J. Opt. Soc. Amer.*, 33, *pp.* 544–554, *Oct.*, 1943.—The paper describes the relations betw. the physical stimulus, the final visual sensation, and the psycho-physical relationships linking them. The luminosity (visibility) function is an example of a psycho-physical concept since it links radiant energy with brightness (used in this report exclusively to denote a sensation). An understanding of this chapter is essential to comprehension of the whole report [Abstr. 383 (1944)] and to the avoidance of confusion between terms and concepts belonging respectively to the physical, the psychical and the psycho-physical (which last includes colour).

J. W. T. W.

535.733.2 388

Farnsworth–Munsell 100-hue and dichotomous tests for colour vision. FARNSWORTH, D. *J. Opt. Soc. Amer.*, 33, *pp.* 568–578, *Oct.*, 1943.—The test consists of a series of (at present) 85 coloured papers which plot as approx. evenly spaced points on a circle on the uniform chromaticity scale diagram. The subject is asked to arrange the samples in a smooth colour series, taking one-quarter of the whole series at a time. From the nature of the errors made, the subject can be classified as normal or as having some specific colour-vision anomaly. A test, somewhat similar in principle, has been devised to test personnel required to discriminate certain code colours in an industrial process. J. W. T. W.

535.81 : 535.243 *see Abstr.* 367

535.82 389

Reflecting microscopes. BURCH, C. R. *Nature, Lond.*, 152, *pp.* 748–749, *Dec.* 25, 1943.—[See Abstr. 2794 (1943)].

536.421.4 390

Simple and differential cryometers for measuring the degree of purity and the freezing temperatures of liquid or melted substances. SWIETOSLAWSKI, W. *J. Phys. Chem.*, 47, *pp.* 590–596, *Nov.*, 1943.—The freezing temperature is measured after an equilibrium is established betw. the liquid and the surrounding cylinder of the solid phase. The solid phase is protected against supercooling by a thin liquid layer formed in betw. the cylinder and the walls of the apparatus. In differential cryometers a thick cylinder of solid phase is formed after each f.p. determination and the remaining liquor is transferred into another part of the apparatus where its f.p. is measured. After this procedure is repeated several times, 2 curves may be established, one of which merges with the straight line $\perp$ the axis of temperature and corresponds to the f.p. of the pure substance under examination. The degree of purity may be estimated by examining the shape of both curves.

536.46 : 533.17 391

Flow states in emergent gas streams. GARSIDE, J. E., HALL, A. R., AND TOWNEND, D. T. A. *Nature, Lond.*, 152, *p.* 748, *Dec.* 25, 1943.

536.46 : 546.262.3 : 535.338.4 *see Abstr.* 376

536.461 392

Abnormal dissociation in flame gases. LEAH, A. S. *Nature, Lond.*, 153, *pp.* 23–24, *Jan.* 1, 1944.

536.462 393

The photographic determination of flame temperatures in closed-vessel explosions. LEAH, A. S. *Phil. Mag.*, 34, *pp.* 795–803, *Dec.*, 1943.—A method of determining flame temperatures of CO mixtures, by correlating pressure rise with photographically determined vol. of inflamed gas, is developed. The temperatures in closed-vessel explosions show an increasing mean flame temperature, and therefore a diminishing latent energy, with distance of flame-travel from the igniting source, thus confirming David's views. [Abstr. 414 (1941)].

536.462 394

Unreleased energy in hydrocarbon flame gases. DAVID, W. T., AND MANN, J. *Phil. Mag.*, 34, *pp.* 816–822, *Dec.*, 1943.—Mixtures, with moist and dry air, of CH_4, C_2H_6, C_3H_8, C_4H_{10}, C_2H_2 and C_4H_8 were burnt at atm. pressure in a special burner and flame temps. were measured by resistance thermometry. Results show that there is abnormal dissociation due to long-lived latent energy in the flame gases [see Abstr. 386 (1943)]. The unreleased energy is 10–20% of the heat of combustion. As the mixture strength is increased, the higher temps. due to the moisture tend to fall to a value at which moist and dry temps. are the same. Explanations of results and the factors affecting the heating of a wire in the flame are discussed. N. M. B.

536.5 : 667.3 395

Temperature control in the hydrosulphite ager. URQUHART, A. R. *J. Text. Inst., Manchr.*, 34, *pp. T*103–*T*124, *Dec.*, 1943.—An investigation was made of the suitability of various types of thermometers for use in ager temperature measurements. A special thermometer was designed to have a very small time lag and other thermometers were compared with this. Pt resistance thermometers give the best results, though for some purposes the Hg-in-steel thermometer with dial indicator is suitable. Typical ager temperature records are given, showing temperature variation with pattern, with position in the ager, cooling by wet and dry greys. A short discussion is given of dye fixation and suggestions are made for the improvement of the ageing process. A. W.

536.658 : 677.31 : 541.183.25 *see Abstr.* 442

536.658.2 : 539.217.1 : 531.724 : 662.66 396

The relation between heat of wetting and the absolute value of the surface area of coals. MAGGS, F. A. P. *J. Inst. Fuel*, 17, *pp.* 49–54, *Dec.*, 1943.—The energy change, exhibited as heat, occurring when a solid/vacuo interface is replaced by a solid/liquid interface is a measure of the surface area involved. Surface-area figures obtained from 2 recent interpretations of adsorption isotherms show mutual agreement, and give the same correlation with heat of wetting as a third independent method. The method was applied to the measurement of the internal surface area of 5 coals, for which adsorption isotherms for methanol were determined in 4 instances, while *n*-hexane was employed for the 5th. The resultant dimensions fell within the size range of colloid particles. A. C. W.

536.66 : 541.636 *see Abstr.* 444

536.7 : 541.123.2.03 *see Abstr.* 424

536.75 397

Principles of Carnot and Clausius. WILSON, W. *Phil. Mag.*, 34, *pp.* 828–833, *Dec.*, 1943.—A critical examination of the statement of the Clausius principle, and considerations with ref. to Ehrenberg's paper [Abstr. 2193 (1943)]. N. M. B.

536.758 : 539.31 : 678 398

Statistical thermodynamics of rubber. III. WALL, F. T. *J. Chem. Phys.*, 11, *pp.* 527–530, *Nov.*, 1943.—A basic postulate used in recent theories of rubber elasticity [Abstr. 2869 (1942)] is re-examined and its equivalent is derived from more fundamental considerations. The postulate dealt with the distribution of molecular lengths in a sample of strained rubber. Equations of state for rubber-like materials are derived by using the conventional methods of statistical mechanics. The results are equivalent to those obtained by other means.

537.12 : 530.145.5 : 537.533 : 535.336 : 538.083.9 = 3 *see Abstr.* 403

537.226 : 541.67 : 621.315.616.96 *see Abstr.* 447

537.228 : 535.327 *see Abstr.* 372

537.228.1 : 553.621 : 548.0 : 621.39 *see Abstr.* 452

537.531.85 : 537.591 *see Abstr.* 401

537.533 : 535.336 : 537.12 : 530.145.5 : 538.083.9 = 3 *see Abstr.* 403

537.533.73 : 541.64 : 539.32 399

The electron diffraction by amorphous polymers. COUMOULOS, G. D. *Proc. Roy. Soc. A*, 182, *pp.* 166–179, *Dec.* 16, 1943.—The configurations of the polyvinyl acetate, and the acrylate and methacrylate polymers, revealed by electron photographs, suggest a zigzag C-atom chain for the long main chain, which has the 1, 3 structure, with the side-chains alternately on the right and the left of the zigzag chains and on planes approx. $\perp$ the axis of the main chain. These side-chains are subject to lateral cohesive forces, which group them in clusters. In the clusters the side-chains tend to arrange themselves parallel to one another. In the lenses the clusters consist of a small number of side-chains without any apparent arrangement, whilst the multilayer pattern indicates a certain orientation of the side-chains with perhaps a larger number grouping together. The patterns indicate an "amorphous" character which is attributed to the tendency of the side-chains to close-packing in clusters, producing distortion of the main chain and thus preventing adlineation. Some of the elastic properties of these polymers are discussed, and a note is made on the occurrence of high elasticity.

537.533.74 400

The scattering and polarization of fast electrons by heavy elements. MOHR, C. B. O. *Proc. Roy. Soc. A*, 182, *pp.* 189–199, *Dec.* 16, 1943.—Using the methods of a previous paper [Abstr. 660 (1941)], the calculation of the scattering and polarization of electrons with energies between 5·4 and 1 060 ekV is extended to the whole angular range for the atomic field of gold. Even at the highest energies the angular distribution of the scattering does not exhibit a monotonic fall with increasing angle, and the asymmetry in double scattering reaches a max. value at angles $> 90°$. The variation of the total elastic cross-section with energy is investigated. A simple closed formula for the scattering is obtained by transforming Dirac's equations into a single differential equation of the same form as Schrödinger's equation but with a modified scattering potential, and then using this potential in Born's approximation. The resulting formula gives angular distributions to which the exact values of the scattering appear to approach more and more closely as the energy of the electrons increases. If a long-range repulsive field is added to the field of the atom so as appreciably to reduce the scattering, the asymmetry in double scattering is reduced by a larger factor.

537.591 : 537.531.85 401

The Compton effect for the meson. BRUNO, B. *Ark. Mat. Astr. Fys.*, 28*B*, 1, *No.* 5, [7 *pp.*], 1942.—The author solves the wave equation of a meson in a monochromatic field and calculates the intensity of the Compton effect by the method of retarded potentials. A. HU.

537.591.1 402

The production of penetrating showers. JÁNOSSY, L., AND ROCHESTER, G. D. *Proc. Roy. Soc. A*, 182, *pp.* 180–188, *Dec.* 16, 1943.—About 1/3 of the radiation producing penetrating showers is non-ionizing and more penetrating than photons. The total intensity of this non-ionizing radiation (named *N*-radiation) is about 0·001% of the full cosmic radiation near sea-level. The *N*-radiation is possibly the energetic part of the penetrating non-ionizing component of cosmic radiation. It is suggested that this radiation consists of neutrons.

538.083.9 : 537.533 : 535.336 : 537.12 : 530.145.5 = 3 403

Determination of magnetic field strength and the fundamental constants e, m and h by a β-spectrometric method. SIEGBAHN, K. *Ark. Mat. Astr. Fys.*, 28*B*, 1, *No.* 6, [3 *pp.*], 1942.—A method is given for measuring the field strength H in a β-spectrograph by observing the radii of curvature of pairs of β-lines whose energy difference is known from X-ray observations. Preliminary results suggest that the accuracy of so measuring a homogeneous field is about 10 times that of direct measurements. Observations of 3 pairs of β-lines give values for H, h/e and e/m whence by use of the Rydberg const. the 3 fundamental constants can be derived at least as accurately as by present methods. A. HU.

538.214 : 541.128.5 404

Magnetic measurements on some catalytically active substances. MORRIS, H., AND SELWOOD, P. W. *J. Amer. Chem. Soc.*, 65, *pp.* 2245–2252, *Nov.*, 1943.—Susceptibility measurements, over a range of temp. and field strength, were made on a series of Ni-activated Cu hydrogenation catalysts, on Ni supported on MgO, and on a catalyst derived from ammonium Ni molybdate. Active Cu-Ni catalysts consist of a continuous series of solid solutions ranging in composition from 66–92·5% Ni. Pure metallic Ni is not present. Thermal deactivation is accompanied by diffusion of Cu into the Ni-rich alloys. Thermal deactivation of Ni supported on MgO proceeds

by a different mechanism; the magnetization is lowered, the Curie point remains the same. Poisons affect a small fraction of the Ni atoms.

538.3 : 530.145 *see Abstr.* 353

538.713 405

A new method of measuring the inclination of the earth's magnetic field. HARRISON, E. P., AND SMITH, E. H. *Proc. Phys. Soc., Lond.*, 56, *pp.* 31–47, *Jan.*, 1944.—The instrument is based on the increase in impedance, due to skin effect, caused by a decrease in axial component of magnetic field in a wire of high-permeability Ni iron when carrying a.c. Four straight wires are arranged accurately in a square, and form the arms of an a.c. bridge. If the plane of the assembly lies in the magnetic meridian plane and is rotated about a horizontal axis, when the total field vector lies in one of the diagonals of the square, the bridge automatically balances and the angle betw. the diagonal and the horizontal plane is the dip. The wires are mounted in a disc, which is itself mounted in a ring within which it can rotate about an axis lying in one of the diagonals of the square. The ring is supported in a base block in such a manner that the whole ring can be rotated about an axis through its centre, $\perp$ the plane of the ring.

539.11 = 3 406

Physics of solid bodies. BUSCH, G. *Bull. Ass. Suisse Élect.*, 34, *pp.* 541–547, *Sept.* 8, 1943.—A review of fundamental questions, particularly of the crystalline state of matter. Thermal, optical and elastic properties, the special properties of the Rochelle salt group, electron emission, supra-conductivity and the rectification properties of semi-conductors, are considered in detail. A. W.

539.132 : 541.57 407

The effect of resonance on the force constants and lengths of chemical bonds. WARHURST, E. *Trans. Faraday Soc.*, 40, *pp.* 26–39, *Jan.*, 1944.—The solution of the secular equation, which gives the energy of the actual state of a molecule in terms of the energies of the resonance states and a resonance integral, is differentiated with resp. to the internuclear separation for one of the bonds in the molecule. From the first differentiation, an equation is derived which illustrates the effect of resonance on the bond length. This is applied to resonance betw. covalent single and double bonds, and to ionic-covalent resonance. The second differentiation gives an equation which shows the effect of resonance on the bond force const. Using this equation, an explanation for the decrease in vibration frequency, which occurs when certain gases are liquefied or dissolved in non-ionizing solvents, has been put forward. Calculations of the magnitude of this effect for the diatomic molecules HCl, HBr, HI and H_2 agree with experimental facts.

539.16 : 533.17 408

Use of radon to trace the flow pattern of gases in furnaces. MAYORCAS, R., AND THRING, M. W. *Nature, Lond.*, 152, *pp.* 723–724, *Dec.* 18, 1943.

539.16.08 409

Measurement of the activity of radiosulphur in barium sulphate. HENDRICKS, R. H., BRYNER, L. C., THOMAS, M. D., AND IVIE, J. O. *J. Phys. Chem.*, 47, *pp.* 469–473, *Oct.*, 1943.—The measurement of the activity of radiosulphur in $BaSO_4$ precipitates can be carried out quantitatively when a definite weight of the solid is deposited uniformly on a polished brass disc and brought to a fixed position with respect to a thin counter window. A convenient arrangement is described, and the variability of the results is defined. The half-life of radiosulphur is $(87{\cdot}1 \pm 1{\cdot}2)$ days, and the absorption by the mica window (3·0 mg./cm.^{2}) is $(49{\cdot}5 \pm 4{\cdot}2)\%$.

539.16.08 : 539.163.2 410

An automatic cloud chamber for nuclear-disintegration studies and a determination of the β-ray spectrum of activated dysprosium. EKLUND, S. *Ark. Mat. Astr. Fys.*, 28*A*, 1, *No.* 3, [18 *pp.*], 1942.—An automatic Wilson chamber of the diaphragm type is described. The coil system is suitable for determinations of particle energy up to 10^7 eV. Lighting is by over-run filament lamps. The electrical circuits, interlocked to give the required cycle of operations, are fully described. The apparatus is employed to record the β-spectrum of Dy^{165}. The distribution found fits the Konopinski–Uhlenbeck curve well. A. HU.

539.163.2 : 539.16.08 *see Abstr.* 410

539.211 : 548 : 535.417 *see Abstr.* 380

539.213.2 411

The vitreous state: some semiquantitative considerations. HUGGINS, M. L. *J. Phys. Chem.*, 47, *pp.* 502–511, *Oct.*, 1943.—The equilibrium between crystalline and non-crystalline conditions in a solid or liquid and the rate at which the equilibrium state is approached are considered as functions of (1) the net energy changes for small internal structural rearrangements, (2) the activation energies for such rearrangements, and (3) the temperature. Annealing and devitrification phenomena and the necessary requirements for the (practically) permanent existence of a vitreous substance are considered.

539.216.1 : 539.26 *see Abstr.* 414, 415

539.217.1 : 531.724 : 662.66 : 536.658.2 *see Abstr.* 396

539.219.1 : 546.98 : 546.11 : 548.73 *see Abstr.* 467

539.24 : 669.14 412

Note on some unusual microstructures observed in mild and medium-carbon steels. SCHOFIELD, T. H. *J. Iron Steel Inst.*, [3 *pp.*], 1943. *Advance copy.*—Envelopes sometimes observed surrounding the pearlite areas in mild and medium-carbon steels are due to the separation of ferrite from the austenite during cooling from temperatures betw. the lower and upper critical points. By very slow cooling from this critical temperature range or by heating steels showing such envelopes below the lower critical point, diffusion takes place and no envelopes are visible.

539.26 413

Detection of the $K\alpha$ satellites on X-ray powder photographs. FARQUHAR, M. C. M., AND WEILL, A. R. *Nature, Lond.*, 153, *pp.* 56–57, *Jan.* 8, 1944.

539.26 : 539.216.1 414

The molecular structure of fibres made from native egg albumin. PALMER, K. J., AND GALVIN, J. A. *J. Amer. Chem. Soc.*, 65, *pp.* 2187–2190, *Nov.*, 1943.—Fibres made from native egg albumin by complex formation with detergent and drawing under steam are composed of parallel bundles of polypeptide chains running parallel to the fibre axis. The peptide

chains have the β-keratin configuration. The tensile strength of the synthetic pure protein fibre depends upon the deg. of molecular orientation and reaches a value of 38 000 lb./in.^{2}

539.26 : 539.216.1 415

X-ray fibre pattern from amylose with a glycerol plasticizer. RUNDLE, R. E., AND DAASCH, L. W. *J. Amer. Chem. Soc.*, 65, *pp.* 2261–2262, *Nov.*, 1943.

539.264 : 541.68 *see Abstr.* 448

539.3 : 679.5 : 539.501 *see Abstr.* 419

539.31 : 678 : 536.758 *see Abstr.* 398

539.319 416

Internal stresses in I-beams. BAUD, R. V., AND INAN, M. *Schweiz. Arch. angew. Wiss. Techn.*, 9, *pp.* 276–287, *Sept.*, 1943.—A report, expanded on the theoretical side, of a study of the internal stresses in rolled, broad-flanged, high-web I-beams. The web has a greater area per vol. and, on removal from the rolling-mill, cools more rapidly than the flanges, thus setting up stresses in the beam. A theory of the stresses is developed, the results of which are verified by photo-elastic observations on a celluloid model.

G. E. A.

539.32 : 539.388.8 : 541.64 *see Abstr.* 445

539.32 : 541.64 : 537.533.73 *see Abstr.* 399

539.388.8 : 539.32 : 541.64 *see Abstr.* 445

539.4.011.25 417

The plastic theories for the ultimate strength of reinforced-concrete beams. EVANS, R. H. *J. Instn Civ. Engrs*, 21, *pp.* 98–121, *Dec.*, 1943.—A résumé of 4 theories is given. The size and nature of 41 beams and their behaviour under test are described, and a comprehensive table gives the results, for these, of the ultimate moment of resistance, and its value as found from each of 8 theories; 4 of these give consistently better agreement with the test results than do the others, but abs. agreement in any one theory is impossible. G. E. A.

539.431 : 620.193 418

Some measurements of corrosion-fatigue made with a new feeding arrangement. HUDDLE, A. U., AND EVANS, U. R. *J. Iron Steel Inst.*, [9 *pp.*], 1943. *Advance copy.*—[Abstr. 245 B (1944)].

539.501 : 539.3 : 679.5 419

The rigidities of solutions of polymers. FERRY, J. D. *Ann. N.Y. Acad. Sci.*, 44, *pp.* 313–327, *Nov.* 12, 1943.—Solutions of a linear polymer of high mol. wt. in a solvent with which it is miscible in all proportions grade uniformly from viscous liquids through gelatinous or rubber-like consistencies to plastic solids. The theory of the mechanical properties of such solutions is discussed in terms of the simplest mechanical model, the Maxwell element. Several methods of determining the rigidities of solutions of polymers are described. The results of measurements of the rigidities of solutions of polybutene, polystyrene, polyvinyl chloride, and polymethyl metacrylate are reviewed. The mechanical properties are discussed in terms of molecular behaviour, with sp. ref. to solutions of polystyrene in xylene. A mechanical model is proposed which describes all the properties of the polystyrene-xylene system, and consists of elements which can be identified with molecular processes.

H. H. HO.

539.501 : 678.7 : 679.5 420

Elasticity and flow in high polymers. SIMHA, R. *Ann. N.Y. Acad. Sci.*, 44, *pp.* 297–312, *Nov.* 12, 1943.—The paper deals with rate phenomena in amorphous materials in general, and particularly in amorphous high polymers, when one of the variables, shearing stress, volume, pressure or temperature, changes rapidly. The molecular mechanisms responsible for the large elastic deformations in rubber-like materials are briefly examined. The case of elastic deformation in high polymers is explored. Under certain simplifications, a statistical treatment will afford numerical results for the equilibrium value of the high elastic component of deformation. Rubber-like elasticity accompanies the existence of relatively free rotation within a chain as determined by the interactions along the main chain skeleton and by the nature and size of the side groups. Distinctions between rubber-like materials (polyisoprene, neoprene, and polyisobutylene) are examined. H. H. HO.

539.531 : 669.14 421

The effect on the hardenability of small additions of chromium and molybdenum to a grain-size-controlled 0·9% nickel steel. STEVEN, W. *J. Iron Steel Inst.*, [13 *pp.*], 1943. *Advance copy.*—Nineteen grain-size-controlled steels of the following foundation analysis (by weight) were made by the crucible process: C (0·33 ± 0·04)%; M (0·60 ± 0·10)%; Si (0·21 ± 0·04)%; S (0·039 ± 0·007)%; P (0·020 ± 0·004)%; Ni (0·89 ± 0·03)%. The effect of simultaneous additions of M and Cr over the range 0–0·6% M and 0·2%–0·8% of Cr was determined by the Jominy end-quench method. The hardenability does not vary as the quenching temp. is altered from 850°C. to 880°C. or as the time of soaking is increased from 20 to 60 min. The relation betw. hardenability and wt. % of Cr and Mo is, ideal crit. dia. $D_\infty = 2{\cdot}36\,Cr^2Mo + 2{\cdot}00\,CrMo + 0{\cdot}60\,Mo + 1{\cdot}70\,Cr + 1{\cdot}31$. Data are tabulated and 3 iso-hardenability diagrams drawn.

539.62 422

Frictional phenomena. XV. GEMANT, A. *J. Appl. Phys.*, 14, *pp.* 456–464, *Sept.*, 1943.—[See Abstr. 2596 (1943)]. External friction between sliding solids founded solely on geometric irregularity of the sliding surfaces is taken as a basis, and the effects of pressure, contact area, speed of sliding, temperature, springiness of the sliding parts and nature of the sliding surfaces on the friction coeff., are considered. Complicating factors include plastic deformation of the surface irregularities, their abrasion and the presence of an adsorbed layer of liquid. G. E. A.

54 : 576.8 : 615 423

Modes of drug action. *Trans. Faraday Soc.*, 39, *pp.* 319–444, *Dec.*, 1943.—A general discussion.

541.123.2.03 : 536.7 424

Thermodynamic properties of solutions of high polymers: the empirical constant in the activity equation. HUGGINS, M. L. *Ann. N.Y. Acad. Sci.*, 44, *pp.* 431–443, *Nov.* 12, 1943.—Using the methods of statistical mechanics, Flory and the author (independently) have calculated the entropy of mixing of binary solutions of flexible long-chain molecules in small-molecule solvents, arriving at the equations for the activities of the components: $\log a_1 = \log V_1$

$+ (1 - \bar{V}_1/\bar{V}_2)V_2 + \mu_1 V_2^2$, $\log a_2 = \log V_2 + (1 - \bar{V}_2/\bar{V}_1)V_1 + \mu_1 V_1^2 \bar{V}_2/\bar{V}_1$ where $\bar{V}_1$ and $\bar{V}_2$ are partial molal vol., V_1 and V_2 vol. fractions, and μ_1 is a const. characteristic of the pair of components. The available empirical information about μ_1 and its variation with temp. and with conc. has been collected and the theoretical dependence of μ_1 on these and other factors is discussed. H. H. HO.

541.123.3 425

On the equilibria of silver and lead, silver and bismuth, and bismuth and lead, with their fluorides at 900°C. JELLINEK, H. H. G. *Trans. Faraday Soc.*, 40, *pp.* 1–5, *Jan.*, 1944.—The equilibrium of Bi and Pb with their fluorides was studied at 900°C. Bi is much nobler than Pb in this reaction. The metal and salt phases respectively are ideal solutions to a first approximation. The heat of formation of BiF_3 is calculated. The equilibria of Bi and Ag, and Ag and Pb, with their fluorides were found unsuitable for investigation in an open reaction vessel as the v.p. of the salts at the required temperatures are too high. A theoretical estimation of the equilibrium constants for these reactions is given.

541.123.3 426

Distribution equilibria between molten metals and molten salts, with reference to the stability of intermetallic compounds in the molten state. HEYMANN, E., MARTIN, R. J. L., AND MULCAHY, M. F. R. *J. Phys. Chem.*, 47, *pp.* 473–484, *Oct.*, 1943.—The distribution curve of Na betw. molten Cd and molten NaBr shows pos. deviations from Raoult's law. The distribution curve of Na betw. molten Pb and molten NaBr shows strong neg. deviations. The solubility of intermetallic compounds of Na with Sn, Sb and Bi, in molten Na halides is discussed. The distribution curve of Cd betw. molten Bi and molten $CdCl_2$ shows an anomalous max. Bi, in the presence of Cd, is slightly soluble in the molten salt, the max. solubility being at atomic fraction 0·5. The distribution curve of Cd between molten Sb and molten $CdCl_2$ is the result of superposition of 2 equilibria, that of the free Cd and that of the compound CdSb betw. the metal phase and the salt phase. The compound is stable at the experimental temperature and soluble in molten $CdCl_2$.

541.124 427

The kinetics of the oxidation of isopropyl alcohol by chromic acid. WESTHEIMER, F. H., AND NOVICK, A. *J. Chem. Phys.*, 11, *pp.* 506–511, *Nov.*, 1943.—The reaction is first order with resp. to $HCrO_4^-$, first order with resp. to the alcohol, and second order with resp. to H^+. The reaction proceeds by way of a compound of tetravalent or of pentavalent Cr.

541.124 : 541.63 428

Potential barriers in ethyl alcohol and the equilibrium in the reaction $C_2H_4 + H_2O \rightleftharpoons C_2H_5OH$. ASTON, J. G., SZASZ, G. J., AND ISSEROW, S. *J. Chem. Phys.*, 11, *pp.* 532–533, *Nov.*, 1943.

541.124 : 541.64 429

Recent results on the kinetics and elementary steps of polyreactions. ABERE, J., GOLDFINGER, G., MARK, H., AND NAIDUS, H. *Ann. N.Y. Acad. Sci.*, 44, *pp.* 267–296, *Nov.* 12, 1943.—The measurements required for a quantitative study of the course of a polymerization or polycondensation reaction are discussed. A description is given of polyreactions consisting of a single elementary step, which repeats itself during the reaction under practically identical conditions and those consisting of initiation, propagation and termination, which include reactions involving vinyl, acrylic acid and butadiene derivatives. All activation processes can and do take place under appropriate experimental conditions. Propagation processes include normal chain growth and branching, while in the case of radical-chain polymerization, termination occurs either if two growing chains collide with their activated ends (free valencies) or if one chain collides with the dissociation product of the catalyst. H. H. HO.

541.124 : 541.64 430

Some aspects of the mechanism of addition polymerization. PRICE, C. C. *Ann. N.Y. Acad. Sci.*, 44, *pp.* 351–370, *Nov.* 12, 1943.—The characteristics of addition-polymerization reactions are discussed, together with the chemical evidence for free-radical activation, kinetic evidence for free-radical propagation, free-radical cessation, chain transfer and inhibition, and the cationic mechanism. H. H. HO.

541.124 : 77.023.4 431

The kinetics of photographic development by hydroxylamine. JAMES, T. H. *J. Phys. Chem.*, 47, *pp.* 597–602, *Nov.*, 1943.—[See Abstr. 2611 (1943)]. The kinetics of development of an actual photographic emulsion by hydroxylamine were studied. The results are in accord with those of previous studies of the reduction of pure AgCl and AgBr. The catalytic mechanism of the latter reactions applies also to photographic development. Fog formation is due primarily to an uncatalysed reaction.

541.124.7 432

The mechanism of the diazo-coupling reaction. I–II. Evidence in favour of the polarization theory. HODGSON, H. H., AND MARSDEN, E. *J. Soc. Dy. Col., Bradford*, 58, *pp.* 228–231, *Nov.*, 1942, *and* 60, *pp.* 16–19, *Jan.*, 1944.—It is shown that the mechanism of coupling is the same whether phenols or amines are second components, and whether the coupling takes place in acid, neutral, alkaline or buffered solutions, and that it is a condensation between the polarized, electrophilic (cationoid) diazo-compound, $R\text{–}N = N\text{–}X$ ($\delta+$ $\delta-$) and the nucleophilic (anionoid) phenol (or phenoxide ion) or amine. It is not a displacement reaction between an electrophilic diazonium ion and a phenol or amine, as claimed by Wistar and Bartlett [*J. Amer. Chem. Soc.*, 52, *p.* 1220, 1930]. Examples are discussed of the decomposition of unstable equilibrium mixtures of diazonium and their isomeric diazo-compounds, whereby the reactions of both types of compound could be simultaneously compared. H. H. HO.

541.127 : 541.64 *see Abstr.* 446

541.127 : 541.64 : 679.5 433

Rate theory and some physical and chemical properties of high polymers. HULBURT, H. M., HARMAN, R. A., TOBOLSKY, A. V., AND EYRING, H. *Ann. N.Y. Acad. Sci.*, 44, *pp.* 371–418, *Nov.* 12, 1943.—The electronic structure of the double bond is considered [Abstr. 3485 (1939)]. Ionic reaction mechanisms

are discussed, in which evidence is given for the possibility of an ionic mechanism in polymerization. Polymerization of vinyl compounds, mol. wt. distribution and radical initiation is considered. An interpretation of the kinetics of styrene polymerization is possible based on the hypothesis that a low-lying triplet state in ethylene is capable of entering into the activated complex in the chain initiation process. Polymeric materials in the rubbery state of aggregation are characterized both by a long range and a local structure. The long-range structure is a polymeric network, the network units being composed of sparsely occurring bonds between the coiled polymeric chains. These bonds may be primary cross links, or secondary bonds such as dipole-dipole bonds, or regions of local crystallinity. The local structure is similar to the local structure of liquids, the segments of the long-chain molecules being in continual, fairly rapid motion, moving from one equilibrium position to the next. The statistics of long-chain molecules, equations of motion for network structures, and the effect of local structure on physical properties, are dealt with at length. H. H. HO.

541.128.1 434

Systematic studies on palladium synthetic-high-polymer catalysts. KAVANAGH, K. E., AND NORD, F. F. *J. Amer. Chem. Soc.*, 65, *pp.* 2121–2125, *Nov.*, 1943.—PVAc in alcohol or acetone is an effective colloidal support for Pd hydrogenation catalysts. The deg. of polymerization of a compound can be so high that a diminution in activity of the colloidal catalyst results. The possibility of using various acetals of PVA, dissolved in acetic acid or dioxane as colloidal carriers for Pd catalysts was demonstrated. The necessity of the presence of water to assure stability and efficiency is shown. PVA–Pd is a superior catalyst to GA–Pd in the presence of thiophene.

541.128.36 : 541.64 435

On the mechanism of inhibition of styrene polymerization. GOLDFINGER, G., SKEIST, I., AND MARK, H. *J. Phys. Chem.*, 47, *pp.* 578–587, *Nov.*, 1943.—The polymerization of styrene was carried out at 70°, 100° and 130°C. with various amounts of benzoquinone as inhibitor. The length of the inhibition period is $\propto$ the amount of inhibitor originally added. The overall rate of polymerization immediately after the induction period and the number-average degree of polymerization of the polymer formed are approx. $\propto$ (amount of inhibitor)$^{-2}$. The activation energy of the initiation reaction is 27 000 cal./mole.

541.128.5 : 538.214 *see Abstr.* 404

541.132 436

Effect of temperature change on the ionization constants of weak electrolytes. JENKINS, H. O. *Trans. Faraday Soc.*, 40, *pp.* 19–22, *Jan.*, 1944.—Existing ionization const. data for formic, acetic, propionic and butyric acids are applied to available theoretical equations and to a new equation $\log K = A/T + (B \log T)/T + (C \log^2 T)/T + D$. Results show satisfactory agreement in each case. Variation of ΔH and ΔC_p with temp. and structure is discussed.

N. M. B.

541.132 437

Microscopic equilibria in ampholytes. HILL, T. L. *J. Amer. Chem. Soc.*, 65, *pp.* 2119–2121, *Nov.*, 1943.—General expressions are derived relating microscopic and macroscopic equilibrium const. of ampholytes. The conc. of any microscopic ion is given in terms of microscopic equilibrium const., the *p*H and the total ampholyte conc. [See Abstr. 1766 (1943)].

541.132 438

The dissociation of dimethyl-ether–boron-trifluoride at low temperatures. BROWN, H. C., AND ADAMS, R. M. *J. Amer. Chem. Soc.*, 65, *pp.* 2253–2254, *Nov.*, 1943.—[See Abstr. 2258 (1943)].

541.132.3 439

Some new complexes of zinc and glycine. GREENWALD, I. *J. Phys. Chem.*, 47, *pp.* 607–621, *Nov.*, 1943.—Mixtures of glycine and $ZnCl_2$ have a greater buffer capacity, betw. *p*H 2·0 and 11·0, than the sum of the two constituents taken separately. The results of the titration of such mixtures with HCl or with OH indicate the existence in solution of $(ZnOOCCH_2NH_3)^{++}$, $(Zn(OOCCH_2NH_3)OH)^{+}$, $Zn(OOCCH_2NH_3)OH$, $(Zn(OOCCH_2NH_3)_2O)^{-}$, and $(Zn(OOCCH_2NH_3)_3O)^{--}$. Consistent values for the constants for the formation of the first 4 of these complexes have been calculated. The value of the const. for the association of the remaining complex cannot be calculated because such association occurs under conditions not susceptible to the mathematical analysis employed. The following were obtained in crystalline condition:

$Zn(HOOCCH_2NH_3)_2Cl_4 \cdot H_2O$,

$Zn(OOCCH_2NH_3)Cl_2 \cdot H_2O$,

$Zn(OOCCH_2NH_3)_3OH \cdot H_2O$,

$Zn(OOCCH_2NH_3)_4ONa \cdot H_2O$

541.133 440

On the nature of molten salts and their mixtures. MULCAHY, M. F. R., AND HEYMANN, E. *J. Phys. Chem.*, 47, *pp.* 485–496, *Oct.*, 1943.—The equivalent conductivity (at corresp. temp.) of molten chlorides of the first and second groups of the periodic table is discussed, assuming that the main factors which influence the mobility are co-ordination and electric forces. The conductivity of mixtures of molten salts shows neg. deviations from additivity, even if activity determinations reveal such mixtures to be ideal. Particularly strong neg. deviations are found when complex formation occurs in the molten mixture. Additional evidence for low activity coefficients and complex formation is discussed.

541.147 441

The darkening of cadmium halides and of antimony oxide by ultra-violet light. COHN, G., AND HEDVALL, J. A. *J. Phys. Chem.*, 47, *pp.* 603–607, *Nov.*, 1943.—The conditions for the darkening of CdI_2, $CdBr_2$ and Sb_2O_3 by ultra-violet light are briefly described. The photosensitivity is dependent on the crystallographic orientation of the surface, respectively on the presence of an unstable modification. The water adsorbed by the crystal is essentially involved in the

chemical process, indicating a relationship between photochemical changes of solids and reactions photosensitized by solids.

541.18 : 532.77 : 532.71 *see Abstr.* 361

541.182.4 : 532.612.4 *see Abstr.* 358

541.182.4 : 532.64 *see Abstr.* 360

541.183.25 : 536.658 : 677.31 442

An analysis of the water adsorption isotherm of wool. SPEAKMAN, J. B. *Trans. Faraday Soc.*, 40, *pp.* 6–10, *Jan.*, 1944.—From an analysis of the water adsorption isotherm of wool and of the rigidity of wool fibres [see Abstr. 2061 (1929)], it is concluded that the water adsorption on wool is of 3 types: α-water which combines with the hydrophilic side-chains with great evolution of heat; loosely bound β-water, which accounts for the fall in rigidity during adsorption and is associated with the peptide groups of the main protein chains, combination being complete when each peptide group is associated with 1 water molecule; and water which condenses in capillary spaces at rel. humidities $> 80\%$. R. W. P.

541.265 : 532.61.08 *see Abstr.* 357

541.57 : 539.132 *see Abstr.* 407

541.62 : 519.41 *see Abstr.* 325

541.63 443

The stereochemistry of co-ordination number eight. Isomers for the trigonal prism with symmetry C_{2v}. MARCHI, L. E. *J. Amer. Chem. Soc.*, 65, *pp.* 2257–2259, *Nov.*, 1943.—[See Abstr. 2058 (1943)].

541.63 : 541.124 *see Abstr.* 428

541.636 : 536.66 444

Steric hindrance and heats of formation. EVANS, A. G., AND POLANYI, M. *Nature, Lond.*, 152, *pp.* 738–740, *Dec.* 25, 1943.—An attempt to build a model of polyisobutene shows great steric interference betw. the CH_3 groups of successive isobutene units. In order to test if the experimental value of the heat of polymerization, which is $<$ the theoretical value, is due to steric interference, the heats of polymerization of isobutene and of the structurally related substances di-isobutene, methyl methylacrylate, and acrylic acid were measured. The trend of results, outlined and discussed in relation to structure and reaction mechanism, indicate that the low heats of polymerization are attributable to steric hindrance.

N. M. B.

541.64 : 539.32 : 537.533.73 *see Abstr.* 399

541.64 : 539.32 : 539.388.8 445

Statistical theory of chain configuration and physical properties of high polymers. I. Rubberlike elasticity. II. Swelling. FLORY, P. J., AND REHNER, J., JR. *J. Chem. Phys.*, 11, *pp.* 512–526, *Nov.*, 1943. *Ann. N.Y. Acad. Sci.*, 44, *pp.* 419–429, *Nov.* 12, 1943. *Abridged.*—The theory is examined in the light of recent knowledge concerning hindrance of rotation about single-valence C–C bonds. The form of the equation expressing the distribution of distances between the ends of the chains is unaffected by hindrance to rotation. The average distance betw. chain ends is increased by hindrance to rotation, but only by a fraction of the difference betw. the chain displacement length and the contour length of the chain. Methods for calculating elastic moduli of polymeric materials possessing network structures (vulcanized rubbers) are discussed, and a new treatment leads to a force/elongation function [Abstr. 2869 (1942)]. Swelling by solvents can be treated as a combination of osmotic dilution opposed by the elastic reaction of the swollen network. Equations are derived for computing the concentration of cross linkages from the equilibrium deg. of swelling.

H. H. HO.

541.64 : 541.124 *see Abstr.* 429, 430

541.64 : 541.127 446

Copolymers of *p*-chlorostyrene and methyl methacrylate. MARVEL, C. S., AND SCHERTZ, G. L. *J. Amer. Chem. Soc.*, 65, *pp.* 2054–2058, *Nov.*, 1943.—The method of interrupted copolymerization of mixed monomers was used to determine the rel. rates at which *p*-chlorostyrene and methyl methacrylate enter a growing copolymer chain. This ratio was 1·46 and remained const. when the temperature, solvents and rel. conc. of the monomers were varied. The same ratio was obtained when *m*-chlorostyrene was substituted for its *para* isomer. Both *m*- and *p*-chlorostyrenes polymerize more rapidly in bulk than styrene when mixtures of the chlorostyrene and styrene were copolymerized. The mol. wts. of chlorostyrene–methyl methacrylate copolymers obtained when the reaction was 9% complete were in the same range as were those when the reaction gave higher conversions. Polymers prepared from mixtures containing more than 1 mole of dimethyl fumarate or di-ethyl maleate per mole of *p*-chlorostyrene contained less than 50 mole % of the symmetrically disubstituted ethylenes.

541.64 : 541.128.36 *see Abstr.* 435

541.64 : 679.5 : 541.127 *see Abstr.* 433

541.653 : 535.563 *see Abstr.* 381

541.653 : 535.566 *see Abstr.* 382

541.66 : 532.14 : 532.133 *see Abstr.* 356

541.67 : 537.226 : 621.315.616.96 447

Electrical properties of solids. XIV. Copolymers of acrylonitrile and ethyl acrylate. MEAD, D. J., AND FUOSS, R. M. *J. Amer. Chem. Soc.*, 65, *pp.* 2067–2069, *Nov.*, 1943.—[See Abstr. 1248 (1943)]. The electrical properties of acrylonitrile–ethyl-acrylate copolymers were measured at power and audio-frequencies at 20°–105°C. The copolymers have properties intermediate betw. those of the simple polymers; with increasing acrylonitrile content, the loss factor max. at a given frequency increases and is displaced toward higher temperatures; simultaneously, the permittivity increases from 12 to 37 in the range 35% to 100% acrylonitrile.

541.68 : 539.264 448

Intermolecular forces and chain configuration in linear polymers. The effect of *N*-methylation on the X-ray structures and properties of linear polyamides. BAKER, W. O., AND FULLER, C. S. *Ann. N.Y. Acad. Sci.*, 44, *pp.* 329–349, *Nov.* 12, 1943.—A series of 9 *N*-methylated polyamides, with methyl substitution varying in polydecamethylene sebacamide from 0 to 55 mol. %, was studied. Young's modulus, moisture sorption and rel. solubility, were chosen as properties representing the gross solids, while the

corresponding fine structure was studied by X-ray diffraction from oriented and unoriented sections. The elastic modulus and hardness decrease with increasing *N*-methylation, rel. solubility increases, moisture sorption increases. The interchain spacings are not changed by the methyl substitution, but at higher amounts of substitution one of the principal spacings (3·76 Å) becomes diffuse. The chains appear retracted by partial folding along the fibre axis. H. H. HO.

541.697 : 576.8.095.18 449

The relation between chemical structure and bacteriostatic activity of sulphanilamide-type compounds. KUMLER, W. D., AND DANIELS, T. C. *J. Amer. Chem. Soc.*, 65, *pp.* 2190–2196, *Nov.*, 1943.—A fundamental factor for activity of sulphanilamide-type compounds is the contribution of the resonating form with a coplanar amino group. The neg. character of the SO_2 group is a concomitant factor. The reason for the maximum in the activity/*pKa* curve for the N_2 mono-substituted sulphanilamides is that in these compounds neutral molecules are more effective in getting the agent to the site of action, and once it gets there, the ion interferes with essential metabolic processes resulting in bacteriostasis. This is also the reason the activities of other types of bacteriostatic agents and local anaesthetics are correlated with their acidic or basic dissociation const.

545.37 450

Systematic polarographic metal analysis. LINGANE, J. J. *Industr. Engng Chem.* (*Analyt. Edit.*), 15, *pp.* 583–590, *Sept.* 15, 1943.—The polarographic characteristics in 9 supporting electrolytes of As, Sb, Bi, Sn, Pb, Cd, Zn and Cu were studied, and complete data are presented for their ½-wave potentials and diffusion current constants. The use of these constants eliminates the need for calibrating each particular dropping electrode with known conc. of the substances to be determined.

545.37 451

A new potentiometric method to determine cations and anions with collodion and protamine-collodion "membrane electrodes." SOLLNER, K. *J. Amer. Chem. Soc.*, 65, *pp.* 2260–2261, *Nov.*, 1943.

545.726 : 614.72 : 535.247.4 *see Abstr.* 368

546.11 : 539.219.1 : 546.98 : 548.73 *see Abstr.* 467

546.262.3 : 536.46 : 535.338.4 *see Abstr.* 376

546.28 : 535.332.03-31 = 3 *see Abstr.* 373

546.98 : 546.11 : 539.219.1 : 548.73 *see Abstr.* 467

548 : 539.211 : 535.417 *see Abstr.* 380

548.0 : 553.621 : 537.228.1 : 621.39 452

Quartz-crystal applications. MASON, W. P. *Bell Syst. Techn. J.*, 22, *pp.* 178–223, *July*, 1943.—Outlines the discovery and development of piezo-electricity, and discusses the use of quartz to control oscillators and to provide selective filters. The various possible modes of vibration are considered and the properties of crystals cut in different directions are described.

J. T.

548.1 : 553.621 453

Methods for specifying quartz crystal orientation and their determination by optical means. BOND, W. L. *Bell Syst. Techn. J.*, 22, *pp.* 224–262, *July*, 1943.—A brief description of the crystallography of quartz is given, and the I.R.E. method of specifying the orientation is explained. Optical methods of determining the orientation are given, including a simple goniometric method, etching, the observation of striations and the use of polarized light. Particular attention is paid to the last method and full details are given of its underlying principles. J. T.

548.32 454

Anion rotation in crystal lattices of A_2BX_4 compounds. BREDIG, M. A. *J. Phys. Chem.*, 47, *pp.* 587–590, *Nov.*, 1943.—[See Abstr. 454 (1943)]. The thermal effect, observed in solid solutions of K_2SO_4 and Na_2SO_4, which was not accompanied by a change in crystal structure, is considered as a second-order transition, and is attributed to the excitation of at least one rotational degree of freedom of the SO_4^{--} ion in the higher temperature range. Such rotation is assumed to occur in the hexagonal high-temperature modifications of other A_2BX_4 compounds where its start may frequently coincide with the change in crystal symmetry at the enantiotropic first-order transition points.

548.33 455

Studies on the coprecipitation of cadmium and mercuric sulphides. RITTNER, E. S., AND SCHULMAN, J. H. *J. Phys. Chem.*, 47, *pp.* 537–543, *Nov.*, 1943.—The formation of CdS-HgS solid solutions takes place at room temperature by direct reaction of the stable or unstable forms of the pure sulphides in contact with highly conc. $(NH_4)_2S$ solution. These solid solutions exist in both zinc blende and the wurtzite structures. No indication of solid solution in the cinnabar structure was observed. Small amounts of Cd in solid solution retard, and larger amounts prevent, the conversion of metacinnabar to cinnabar by $(NH_4)_2S$ solution. By coprecipitation of CdS and HgS from acid solutions, only solid solutions in the zinc-blende type of structure were obtained from nitrate solutions, while wurtzite-type solutions were also obtained from chlorides. A black variety of HgS was prepared which has the structure of cinnabar.

548.55 : 548.73 *see Abstr.* 468

548.73/.74 456

Zinc oxide smoke as a reference standard in electron wavelength calibration. CHIA-SI LU AND MALMBERG, E. W. *Rev. Sci. Instrum.*, 14, *pp.* 271–273, *Sept.*, 1943.—ZnO smoke and thinned Au foil were studied with X-rays and electrons. X-ray values for lattice constants of ZnO and electron diffraction value for its axial ratio agree with Bunn's X-ray values [Abstr. 3742 (1935)]. With reg. to rel. values for the lattice constants of ZnO and Au, both methods give consistent results. The wavelength calibrations are in agreement. [Abstr. 4806 (1937)].

548.73 457

The structure of molecular compounds. II. POWELL, H. M., AND HUSE, G. *J. Chem. Soc.*, *pp.* 435–437, *Sept.*, 1943.—Evidence from m.p. and the intensities of reflection of X-rays, incl. diffuse spectra, of crystals of intermolecular compounds is against the existence of ions in the structures. The structures of the intermolecular compounds of the picryl halides and hexamethylbenzene are very complex and dis-

ordered and consist of alternate layers of the 2 components, and the binding betw. the layers is weak. See Abstr. 2448 (1943)].

548.73 458

X-ray diffraction of sodium laurate, palmitate and stearate at room temperature. McBAIN, J. W., BOLDUAN, O. E. A., AND ROSS, S. *J. Amer. Chem. Soc.*, 65, *pp.* 1873–1876, *Oct.*, 1943.—Fibre as well as powder photographs of Na laurate, palmitate and stearate were made. They confirm the unit cell of the β form of monoclinic soap and give the unit cell for a hydrated γ form. The strongest characteristic β line in the powder diagram corresponds to $d/n = 4{\cdot}28$ Å, whereas that of the hydrated γ or γ phase is $d/n = 4{\cdot}00$ Å.

548.73 459

Diffraction of X-rays by sodium laurate and sodium palmitate at higher temperatures. BOLDUAN, O. E. A., McBAIN, J. W., AND ROSS, S. *J. Phys. Chem.*, 47, *pp.* 528–535, *Oct.*, 1943.—Fibre photographs of the supercurd, subwaxy and waxy crystalline phases of Na laurate and palmitate are described; each is the most stable phase over a definite region of temperature. The existence of the transition curd $\rightleftarrows$ supercurd at about 70°C. for Na laurate is indicated, conforming to its occurrence already established for the myristate, palmitate, stearate and oleate.

548.73 460

Secondary non-Laue reflections from phloroglucine dihydrate. BANERJEE, K., AND BOSE, C. R. *Nature, Lond.*, 153, *p.* 23, *Jan.* 1, 1944.

548.73 461

The crystal structure of ethylene. BUNN, C. W. *Trans. Faraday Soc.*, 40, *pp.* 23–25, *Jan.*, 1944.—Positions of C atoms which account for published X-ray data on ethylene crystals are suggested. The details of this structure are: Unit cell—orthorhombic, with $a = 4{\cdot}87$ Å, $b = 6{\cdot}46$ Å, $c = 4{\cdot}14$ Å. Space group—*Pnnm* (D_{2h}^{12}). Co-ordinates of C atoms—(1) $xy0$; (2) $\bar{x}\bar{y}0$; (3) $0{\cdot}5 - x$, $0{\cdot}5 + y$, $0{\cdot}5$; (4) $0{\cdot}5 + x$, $0{\cdot}5 - y$, $0{\cdot}5$, where $x = 0{\cdot}11a$, and $y = 0{\cdot}06b$. The interatomic distances in this arrangement agree with those found in related substances.

548.73 462

X-ray diffraction studies on precipitated cuprous and cupric sulphides. WEISER, H. B., MILLIGAN, W. O., AND MARSHALL, J. M., JR. *J. Phys. Chem.*, 47, *pp.* 496–501, *Oct.*, 1943.—The reaction of H_2S with solutions of CuCl gives Cu_2S, and the reaction of H_2S with $CuCl_2$ solutions gives CuS (covellite pattern). This is true whether the gels are freshly prepared or are aged under water at room temperature or at 90°C. The extra lines which appear in the X-ray diffraction patterns of some samples of CuCl and $CuCl_2$ which have been exposed to the air while moist, correspond to the stronger lines of the diffraction pattern of $CuSO_4 . 5H_2O$. Samples of the sulphides protected against oxidation, or prepared and examined rapidly without precautions against oxidation, do not give lines corresp. to $CuSO_4 . 5H_2O$. Coprecipitated gels of CuCl and $CuCl_2$ gave X-radiograms corresp. to mixtures of chalcocite and covellite; some indication of solid solution was observed, but there was no indication of the formation of digenite.

548.73 46

The crystal structure of silver oxalate. GRIFFITH R. L. *J. Chem. Phys.*, 11, *pp.* 499–505, *Nov.*, 1943.—An X-ray diffraction study reveals that $Ag_2C_2O_4$ i monoclinic, having the symmetry of the space grou $P2_1/c - C_{2h}^5$. The unit cell has the dimensions $a = (3{\cdot}46 \pm 0{\cdot}02)$ Å, $b = (6{\cdot}16 \pm 0{\cdot}02)$ Å, $= (9{\cdot}47 \pm 0{\cdot}04)$ Å, $\beta = 76° \pm 1°$. There are $Ag_2C_2O_4$ mol. per unit cell. All atoms are locate in sets of 4-fold general positions. The parameter of the Ag and O atoms are determined from 2-dimen sional Fourier syntheses, using the exp. factors fo the $h0l$ and $0kl$ planes. The positions of the C atom are approx. determined by requiring that the C–C and C–O bond distances be reasonable. The struc ture may be considered to be made up of chain mole cules of composition $(Ag_2C_2O_4)_x$ extending through the lattice parallel to the b axis. These chains appea to be held together by longer Ag–O bonds to form th 3-dimensional structure.

548.73 46

Crystal-chemical studies of the alums. V. The gallium alums. KLUG, H. P., AND KIEFFER, G. L *J. Amer. Chem. Soc.*, 65, *pp.* 2071–2072, *Nov.*, 1943.—Lattice consts. for Ga alums were determined a $(25 \pm 0{\cdot}1)$°C. The densities were calculated from X-ray data. All the Ga alums investigated have th α structure except those of Cs and Tl which possess the β structure.

548.73 : 517.512.2 : 518.3 46

Interpretation of Patterson diagrams. ROBERT SON, J. M. *Nature, Lond.*, 152, *pp.* 411–412, *Oct.* 9 1943.—Describes a geometrical construction which may be useful in dealing with structures having a moderately large number of similar atoms, where the Patterson method becomes involved. J. T.

548.73 : 517.512.2 : 518.3 46

Interpretation of Patterson diagrams. HÄGG, G *Nature, Lond.*, 153, *p.* 81, *Jan.* 15, 1944.—A modified method is suggested. [See Abstr. 465 (1944)].

548.73 : 539.219.1 : 546.98 : 546.11 467

X-ray study of the hysteresis effect observed in the palladium-hydrogen system. OWEN, E. A., AND WILLIAMS, E. ST. J. *Proc. Phys. Soc. Lond.*, 56, *pp.* 52–63, *Jan.*, 1944.—[See Abstr. 4290 (1937)] The hysteresis effect observed in the Pd-H system when the pressure is varied was investigated by the X-ray method at 60°–130°C. The effect of charging the specimens with H for long periods was examined. Definite relations were observed between the temperature and certain critical values of the pressure connected with the appearance and disappearance of the two phases present in the system. The α-phase lines in the structure spectra were initially sharply defined, but the β-phase lines were always diffuse, and so also were the α-phase lines when the phase reappeared again on decreasing the pressure of the gas. The behaviour of charged Pd under various conditions in the region of pressure where hysteresis occurs is remarkably definite.

548.73 : 548.55 468

A new direct method of indexing single-crystal X-ray photographs—the "tilted crystal" method. BUNN, C. W., PEISER, H. S., AND TURNER-JONES, A. *J. Sci.*

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Instrum., 21, *pp.* 10–15, *Jan.*, 1944.—The method is based on the interpretation of the exact positions of the X-ray reflections produced by a crystal rotating or oscillating about a direction which is slightly inclined to a crystallographic axis. The principles, the mathematical basis and the applications of the new method are discussed rel. to other methods available. The tilted-crystal method may also be used for obtaining information about crystal symmetry.

548.73 : 778.3 469

Technique of intensity measurements in X-ray crystal analysis by photographic methods. ROBERTSON, J. M. *J. Sci. Instrum.*, 20, *pp.* 175–179, *Nov.*, 1943.—Stresses the need for care in the production and measurement of X-ray photographs for crystal analysis. The techniques described include the multiple-film technique, the calibration of the film by intensity wedges, to produce which rotating sectors are used, and the employment of std. crystals. J. T.

549.211 470

Industrial diamonds. GALLOWAY, D. F. *Engineering*, 156, *pp.* 441–444, *Dec.* 3, 1943.—A general account of the production and uses, with characteristic figures, methods of cutting, grinding and polishing, etc. The production of diamond-tipped cutting tools is fully described. E. H. W. B.

550.342 : 534.647 *see Abstr.* 365

550.381 471

List of geomagnetic observatories and thesaurus of values. II. FLEMING, J. A., AND SCOTT, W. E. *Terr. Magn. Atmos. Elect.*, 48, *pp.* 171–182, *Sept.*, 1943.

550.384 : 523.746 472

Solar and magnetic data, April to June, 1943, Mount Wilson Observatory. NICHOLSON, S. B., AND MULDERS, E. S. *Terr. Magn. Atmos. Elect.*, 48, *pp.* 186–187, *Sept.*, 1943.

550.384.3 473

Periodic changes in ΔD at Oslo, 1843–1930. WASSERFALL, K. F. *Terr. Magn. Atmos. Elect.*, 48, *pp.* 145–150, *Sept.*, 1943.—Annual mean values of the diurnal variation in magnetic declination D are examined for periodicities. The well-marked 11-year period shows a continuous decrease in amplitude from 1840 to 1930. An 8-month period is also found. It is suggested that a 35-year undulation found in the secular variation of D is connected with the Brückner cycle in air temperature and precipitation. A. HU.

550.384.4 474

Three-hour range index K at Dombås Observatory during 1939 to 1942. WASSERFALL, K. F. *Terr. Magn. Atmos. Elect.*, 48, *pp.* 151–160, *Sept.*, 1943.—The international index K characterizing the variation in degree of irregular magnetic activity throughout each day is given from Dombås observations in the form of annual means, and monthly and annual frequency curves are derived for quiet and disturbed conditions. The data show the 27-day recurrence tendency due to the sun's rotation. A. HU.

550.385 475

Principal magnetic storms, April to June, 1943. *Terr. Magn. Atmos. Elect.*, 48, *pp.* 188–190, *Sept.*, 1943.

550.389 476

American magnetic character-figure, C_A, three-hour-range indices, K, and mean K-indices, K_A, for April to June, 1943. JOHNSTON, H. F. *Terr. Magn. Atmos. Elect.*, 48, *pp.* 163–166, *Sept.*, 1943.

551.243.1 : 526.77 *see Abstr.* 349

551.465 : 551.509 *see Abstr.* 479

551.508.5 477

A design for a swinging-plate anemometer. MAY, K. R. *J. Sci. Instrum.*, 20, *pp.* 196–197, *Dec.*, 1943.

551.508.71 : 533.275 478

Precision hygrometry with a wet bulb. BALLS, W. L. *Nature, Lond.*, 152, *pp.* 389–390, *Oct.* 2, 1943.—Experimental work has led to a method having a consistent accuracy within 0·5% R.H. over long periods. Air is aspirated over the bulbs for 2 min., the wet bulb being continuously immersed except whilst readings are being made. Thermometer readings to within 0·1°F. are required. Details of the apparatus and the precautions required for the highest accuracy are given. E. H. W. B.

551.509 : 551.465 479

Forecasting the state of the sea and swell. MOOK, C. P. *Bull. Amer. Met. Soc.*, 24, *pp.* 239–242, *June*, 1943.—Max. height of wind-induced waves is related semi-empirically to fetch and to wind speed. Swells travelling outward from the wind centre are shown to become longer and lower with increasing distance, and methods for their forecasting are discussed. A. HU.

551.509.3 : 551.575 480

Use of a heating/condensation ratio in time-forecasting of fog in the Great Valley of California. MATHEWS, D. A. *Bull. Amer. Met. Soc.*, 24, *pp.* 231–238, *June*, 1943.—The formation of fog in air masses trapped in the Valley is compared with the laboratory production in a closed box. The main difference is the variable radiation caused by differing sky transparency. Sky condition is eliminated from the expression giving the time of formation of fog by radiative cooling; and by determining condensation as a ratio betw. change in dew point and change in temperature, a theoretical cycle of fog formation is derived. Empirical terms are used to correlate this cycle with the observed one. The resulting expression can be used for satisfactory fog prediction. A. HU.

551.51 481

Twenty-five years' progress in meteorological science. MAHAFFY, F. *J. Roy. Astr. Soc. Can.*, 37, *pp.* 319–332, *Oct.*, 1943.—A semi-popular review of recent developments in the theory of fronts and air-masses, and in the methods of upper-air sounding. A. HU.

551.510.535 = 3 482

On the daily variation in maximum electron concentration in the F2 layer of the ionosphere. HECHTEL, R. *Hochfrequenztechn. u. Elektroakust.*, 57, *pp.* 108–111, *April*, 1941.—From the daily variation of electron concentration the daily temperature variation is calculated. It shows a max. in the early afternoon and a min. at sunrise. The ratio of extreme values depends on the recombination factor and is abt. 4·5 : 1 in summer. The ion production at midday is at least 60 ions or electrons per cm.^{3} per sec. R. N.

551.513.1 483

The correlation between specific humidity and potential vorticity in the atmosphere. SPAR, J. *Bull. Amer. Met. Soc.*, 24, *pp.* 196–200, *May*, 1943.—Pilot-balloon and radiosonde observations made in the early part of 1940 in the eastern U.S. are used to establish an inverse correlation betw. specific humidity and potential vorticity, using atmospheric layers bounded by potential temperature surfaces 4°C. apart as autobarotropic slabs. Potential vorticity is therefore a conservative property of air masses. A. HU.

551.513.2 484

Analytical interpretation of density currents of air chilled by nocturnal radiation. BROOKS, F. A., AND BERGGREN, W. P. *Bull. Amer. Met. Soc.*, 24, *pp.* 247–248, *June*, 1943.—Observed density profiles are used to compute the down-slope pressure gradients due to the vertical gradient of density. Integration of these gives the shear stress over planes parallel to the slope. The Prandtl equation is modified to make it applicable to density currents. The stability criterion is given in a new form, the modified expression $\to 1$ as the original $\to \infty$, for the conditions in which only a residual laminar flow is permitted. This alternative form has theoretical advantages. A. HU.

551.515.4 485

The determination of vertical velocities in thunderstorms. II. BUELL, C. E. *Bull. Amer. Met. Soc.*, 24, *pp.* 211–212, *May*, 1943.—The expression used [Abstr. 2640 (1943)] for the max. vertical velocity in terms of the discontinuity in the surface barograph trace is derived more exactly for the 3 cases there treated. A. HU.

551.515.41 486

Dynamics of thunderstorms. MALURKAR, S. L. *Proc. Indian Acad. Sci. A*, 18, *pp.* 20–27, *July*, 1943.—The initial convection in the development of a thunderstorm is not due to an anomalous potential density distribution but to the surfaces of equal temperature or equal humidity not being horizontal, to wind velocity gradients and to other causes. Convection is maintained by a regenerative process in which the momentum of an upward current of relatively dry air causes it to overshoot its hydrostatic equilibrium level and to condense much higher up, the latent heat released continuing the process. A. HU.

551.521.11(262) 487

Sunshine and cloudiness in the Mediterranean basin. GORCZYNSKI, W. *Bull. Amer. Met. Soc.*, 24, *pp.* 183–193, *May*, 1943.—The Mediterranean type of climate is described in terms of cloudiness, and similar regions in Australia and in N. and S. America are defined. Maps compare the day-time cloudiness and average percentages of possible sunshine in N. America with those in Europe and N. Africa. A. HU.

551.521.12 488

Actinometric observations on Mt. Kanobili during 1940. CHKHAIDSE, S. M. *Bull. Abastumani Astrophys. Obs.*, 6, *pp.* 165–168, 1942.—Daily values of the intensity of solar radiation in gm. cal./cm.^{2} min. are given for different air masses from observations with a Michelson actinometer. Values reduced to a noon horizontal surface and to a noon surface perpendicular to the rays are tabulated and monthly means derived. A. HU.

551.521.3 489

Transmission of the total and the infra-red component of solar radiation through a smoky atmosphere. HAND, I. F. *Bull. Amer. Met. Soc.*, 24, *pp.* 201–204, *May*, 1943.—Pyrheliometer measures of the total and infra-red ($> 0{\cdot}7\ \mu$) radiation before and during the passage of a smoke cloud due to a forest fire show a range in the former 2·3 times as great as in the latter, confirming that long waves are more readily transmitted through particles $\sim 1\ \mu$ in dia. than short waves. A. HU.

551.524.35(48) 490

Warm winters and cold winters in Scandinavia. SANDSTRÖM, J. W. *Ark. Mat. Astr. Fys.*, 28*A*, 1, *No.* 1, [3 *pp.*], 1942.—Data collected from 207 stations and extending over the period 1871–1930 are used to discriminate betw. temperature excesses and defects in January in Scandinavia. Maps showing temperature deviations, atmospheric pressures and air movements for the mean of 20 warm winters and 14 cold winters are reproduced. Warm winters are due to warm air currents from low lat., whilst cold winters are generated in Scandinavia itself. A close negative correlation exists betw. winter temperatures in Scandinavia and in W. Greenland. A. HU.

551.543.5 491

Parabolic law of the changes of the atmospheric pressure. AGOSTINHO, J. *Bull. Amer. Met. Soc.*, 24, *pp.* 215–216, *May*, 1943.—The variation with time of the barometric pressure at sea level in the Azores, corrected for the diurnal tide, can be represented by successive parabolas whose points of contact usually coincide with fronts. The barometric tendency is therefore linear with time betw. fronts. It always tends to lower the pressure, and its slope varies within narrow limits. A. HU.

551.547.1 : 518.3 492

A pressure/height nomogram for use by the practical forecaster. FLETCHER, R. D., AND GRAHAM, R. D. *Bull. Amer. Met. Soc.*, 24, *pp.* 282–284, *Sept.*, 1943.

551.553.21 493

Monsoon cyclones. SEN, S. N. *Sci. and Cult.*, 9, *p.* 90, *Aug.*, 1943.

551.555.8(661) 494

A summary of knowledge of the sand and dust storms of French West Africa. HUBERT, H. *Bull. Amer. Met. Soc.*, 24, *pp.* 243–246, *June*, 1943.—The semi-permanent dry haze of winter in W. Africa, which decreases horizontal visibility to about 10 km. is distinguished from the transient winter dust storms caused by the northerly trades when their velocity reaches about 10 m./sec. The material transported by the latter is quartz and clay. Line-squall sandstorms are of still shorter duration ($\sim$ 20 min.), occur in summer and move in a westerly direction. Forecasting of these phenomena depends upon accurate forecasting of wind speed. A. HU.

551.575 : 551.509.3 *see Abstr.* 480

551.576.1 : 533.6.013.22 495

Cumulo-nimbus hazard to aircraft. STANLEY, R. M. *Bull. Amer. Met. Soc.*, 24, *pp.* 213–214, *May*, 1943.—Barograph and accelerograph observations from gliders and powered aircraft in the interior of thunder-

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clouds are described. Rates of climb of 4 000 ft./min. may persist for 5 min., and accelerations of 10 *g* may be encountered. The conditions are of extreme hazard, and flying should not be deliberately attempted near such clouds except in aircraft specially designed with high factors of safety. A. HU.

551.588(7) 496

Some climatic influences of the Great Lakes, latitude and mountains: an analysis of climatic charts in "Climate and Man," 1941. II. VISHER, S. S. *Bull. Amer. Met. Soc.*, 24, *pp.* 205–210, *May*, 1943.—The author continues his synoptic study of U.S. climate [Abstr. 2960 (1943)]. The Great Lakes reduce the temperature range in their neighbourhood, prolong the frost-free period, decrease rainfall and increase snowfall. Latitude influences the distribution of low temperatures, storms and clear days. The major effect of mountain ranges is on precipitation and temperature. A. HU.

551.593.63 497

Ice-crystal haloes. SAVILE, D. B. O. *Nature, Lond.*, 153, *p.* 25, *Jan.* 1, 1944.

551.594.2 : 621.396.821 498

Thunderstorms and their electrical effects. SCHONLAND, B. F. J. *Proc. Phys. Soc., Lond.*, 55, *pp.* 445–458, *Nov.*, 1943.—The second Charles Chree Address gives a summarizing survey of the work carried out by the author and his collaborators on which much of the modern knowledge of the mechanism of the lightning stroke and the forms of atmospherics is based [see Abstr. 2154 B (1940), 201 A (1939)].

R. H. G.

551.594.5 499

The aurora borealis as seen from Edmonton. ANGUS, W. K. *J. Roy. Astr. Soc. Can.*, 37, *pp.* 316–318, *Oct.*, 1943.—Observations made over 400 nights in 1941 and 1942 are analysed, the frequencies of various forms, colours and intensities of the display being deduced. A. HU.

553.621 : 537.228.1 : 548.0 : 621.39 *see Abstr.* 452

553.621 : 548.1 *see Abstr.* 453

576.33 500

Note on anodal excitation. HOUSEHOLDER, A. S. *Bull. Math. Biophys.*, 5, *pp.* 91–94, *Sept.*, 1943.—A general, necessary and sufficient condition for the occurrence of anodal excitation is given on the basis of Rashevsky's 2-factor theory of excitation, expressions for the anodal rheobase and the minimal shock intensity following as simple special cases.

576.8 : 615 : 54 *see Abstr.* 423

576.8.095.18 : 541.697 *see Abstr.* 449

593.121 501

On the theory of amoeboid movements. RASHEVSKY, N. *Bull. Math. Biophys.*, 5, *pp.* 95–102, *Sept.*, 1943.—It is shown how the application of the principle of max. energy transformation [Abstr. 1604 (1943)] leads to expressions which give the probability of occurrence of a pseudopod of a given size and duration in function of other physical constants of the amoeba.

614.72 : 545.726 : 535.247.4 *see Abstr.* 368

615 : 576.8 : 54 *see Abstr.* 423

66.047 502

A laboratory spray drier. WOODCOCK, A. H. AND TESSIER, H. *Canad. J. Res. A*, 21, *pp.* 75–78, *Sept.*, 1943.—A laboratory model of a cyclone type of spray drier is described. The main drying chamber is an inverted cone 2 ft. dia. at the base and 5 ft. 2 in. high. Adjustments are provided for inlet air temperature, total air flow, angular velocity of air in the drying chamber, quantity of liquid introduced, and spraying technique.

662.66 : 539.217.1 : 531.724 : 536.658.2 *see Abstr.* 396

666.032 503

A simple glass-blowing machine. PHILLIPS, C. E. S. *J. Sci. Instrum.*, 21, *pp.* 17–18, *Jan.*, 1944.—Two self-centring chucks, with means for blowing into a glass tube held between them while rotating, allows useful operations to be performed with the simplest equipment. Constructional details are given. F. T. F.

667 : 535.347 = 4 *see Abstr.* 379

667.3 : 536.5 *see Abstr.* 395

669.14 504

The structure and segregation of two ingots of ingot iron, one containing lead. NORTHCOTT, L., AND MCLEAN, D. *J. Iron Steel Inst.*, [11 *pp.*], 1943. *Advance copy. Engineering*, 157, *pp.* 18–20, *Jan.* 7, 1944.—Two ingots were obtained from the same melt, a Pb addition being made to the mould in one case but not the other. Noticeable Pb segregation occurred at the extreme base of the ingot, but, in general, the Pb distribution was very similar to that of the S and P. The coarse nature of the particles of Pb in the core of the Pb-bearing ingot was confirmed by radiographs which showed isolated small particles of Pb on sections cut from the core, whereas no clear evidence of Pb was obtained in sections from the rim. The energy absorbed in machinability tests was 25% less with the Pb-bearing ingot than with the Pb-free steel. A. C. W.

669.14 505

A study of austenitic grain growth in medium carbon steels. WHITELEY, J. H. *J. Iron Steel Inst.*, [56 *pp.*], 1943. *Advance copy.*—The austenitic grain boundaries at the temp. of heating were ascertained by the ferrite precipitation method, and the grain sizes were recorded by counting the number present in 10 in.^{2} at a magnification of 100. Eight independent factors were found to influence grain-growth: temp., length and rate of heating, initial grain size, hot work and the Al content of the steel, the rate of cooling from the solidus to 1 200°C., and the state of the carbide. Grain refinement takes place almost entirely at the Ac_1 transformation and is completed during the passage through the critical stage. In the coarse-grained steels, the rate of growth steadily increased with the temp. of heating, and, below about 1 100°C., a state of virtual stability was eventually reached. In the fine-grained steels, a halt in grain development occurred almost immediately after the refinement, and, below 900°C., this period of inactivity was so indefinitely long that the steel was fine-grained in character. A. C. W.

669.14 : 539.24 *see Abstr.* 412

669.14 : 539.531 *see Abstr.* 421

669.183 506

Survey of liquid-steel temperatures in basic open-hearth furnaces. MANTERFIELD, D. *J. Iron Steel Inst.*, [13 *pp.*], 1943. *Advance copy.*—Details are given of the type of furnace and slag dealt with. Temperatures were taken by the Schofield–Grace quick-immersion pyrometer, with a portable potentiometer. Readings were taken at various positions in the vertical and horizontal plane, and the results are tabulated and discussed. A point in the centre of the bath at a depth of 9 in. in the steel is the std. position for measurement. A series of typical time/temperature diagrams is given, with details of the furnace additions. At the beginning of the refining period an average superheat (over the m.p.) of 40°C. prevails, rising to 70°–100°C. at the going-on stage. The response of the metal to alteration in flame conditions is discussed. A number of slag and metal temperatures was taken, the metal at the std. depth and the slag at a depth of 2 in. During the reaction period the activity equalizes the temperature of both the slag and the metal. In the final stages of refining a greater difference was found.

677.31 : 536.658 : 541.183.25 *see Abstr.* 442

678 + 679.5 *see Abstr.* 508

678 : 539.31 : 536.758 *see Abstr.* 398

678.046 507

Carbon black in butyl rubber. TURNER, L. B., HAWORTH, J. P., SMITH, W. C., AND ZAPP, R. L. *Industr. Engng Chem.*, 35, *pp.* 958–963, *Sept.*, 1943.—Data are given on the effects on physical properties of butyl rubber, of varying the type and conc. of the carbon black pigment. The relation of the results to particle size and chemical nature of the surface of the different blacks is discussed. E. R. A.

678.7 : 679.5 : 539.501 *see Abstr.* 420

679.5 + 678 508

High polymers. *Ann. N.Y. Acad. Sci.*, 44, *pp.* 265–443, *Nov.* 12, 1943.—A symposium of papers presented at the N.Y. Acad. Sci. Conference. Introduction to the Conference on high polymers, Fuoss, R. M.; Recent results on the kinetics and elementary steps of polyreactions, Abere, J., Goldfinger, G., Mark, H., and Naidus, H. [Abstr. 429 (1944)]; Elasticity and flow in high polymers, Simha, R. [Abstr. 420 (1944)]; The rigidities of solutions of polymers, Ferry, J. D. [Abstr. 419 (1944)]; Intermolecular forces and chain configuration in linear polymers. The effect of *N*-methylation on the X-ray structures and properties of linear polyamides, Baker, W. O., and Fuller, C. S. [Abstr. 448 (1944)]; Some aspects of the mechanism of addition polymerization, Price, C. C. [Abstr. 430 (1944)]; Rate theory and some physical and chemical properties of high polymers, Hulburt, H. M., Harman, R. A., Tobolsky, A. V., and Eyring, H. [Abstr. 433 (1944)]; Statistical theory of chain configuration and physical properties of high polymers, Flory, P. J., and Rehner, J., JR. [Abstr. 445 (1944)]; Thermodynamic properties of solutions of high polymers: the empirical constant in the activity equation, Huggins, M. L. [Abstr. 424 (1944)].

679.5 : 539.3 : 539.501 *see Abstr.* 419

679.5 : 541.64 : 541.127 *see Abstr.* 433

679.5 : 678.7 : 539.501 *see Abstr.* 420

681.4 : 535.313.2 : 522.21 *see Abstr.* 330

77.019 509

On contrast and definition. SPIEGLER, G. *Photogr. J.*, 83, *pp.* 410–413, *Dec.*, 1943.—The investigations on contrast, definition and blurring described, although carried out partly for X-rays, are applicable to photographic work of all kinds, the principles involved being independent of the nature of the radiation. Points investigated include the effect of exposure on the spreading of the image and the measurement of unsharpness. The addition of blurrings is also discussed. A. H.

77.023.4 : 541.124 *see Abstr.* 431

771.53 510

The Herschel effect in relation to a critical size of development centres. KORNFELD, G., AND JAMES, T. H. *J. Opt. Soc. Amer.*, 33, *pp.* 615–618, *Nov.*, 1943.—On investigation at different density steps and with varying times of irradiation, the Herschel effect proves to be a reaction which starts in each development centre upon the absorption of 1 quantum. At low initial densities, a large number of the developable grains revert to the undevelopable state upon the removal of 1 or 2 Ag atoms per centre.

771.535 511

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778.3 : 548.73 *see Abstr.* 469

778.37 512

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778.4 513

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778.6 : 535.612 : 535.7 *see Abstr.* 386